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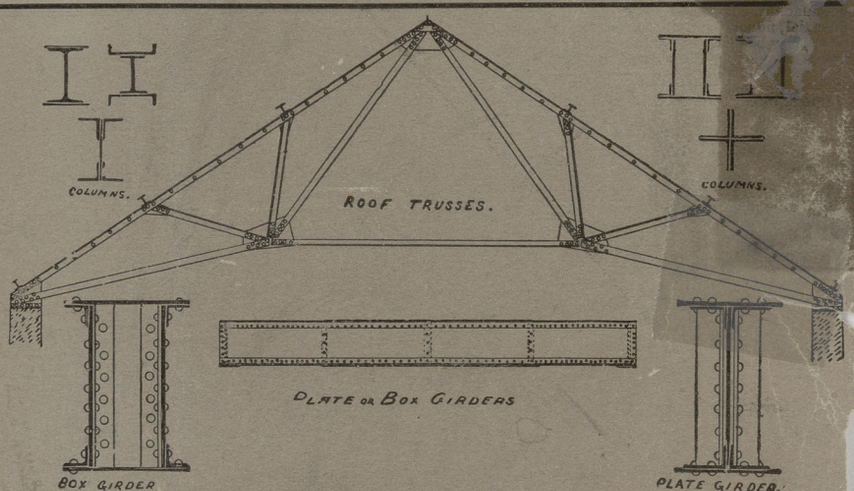
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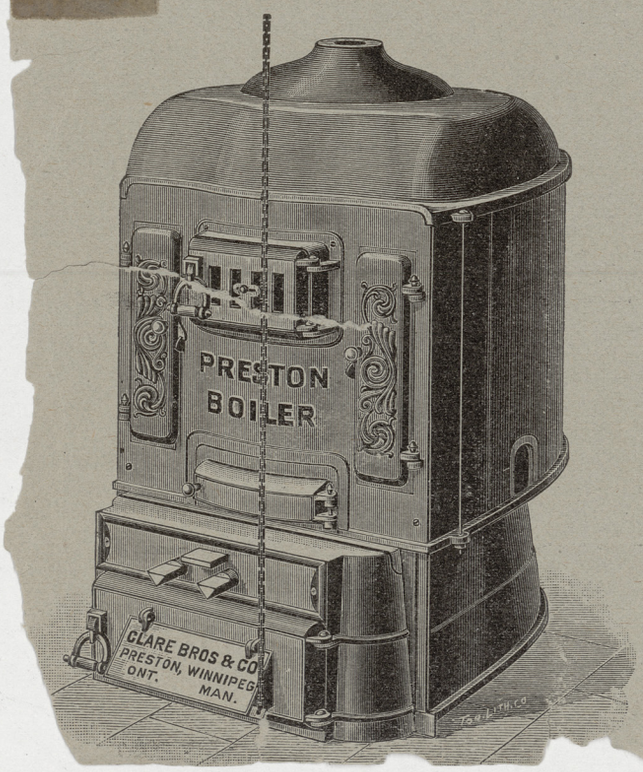
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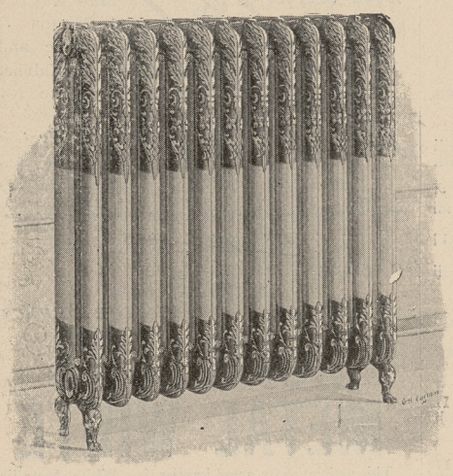
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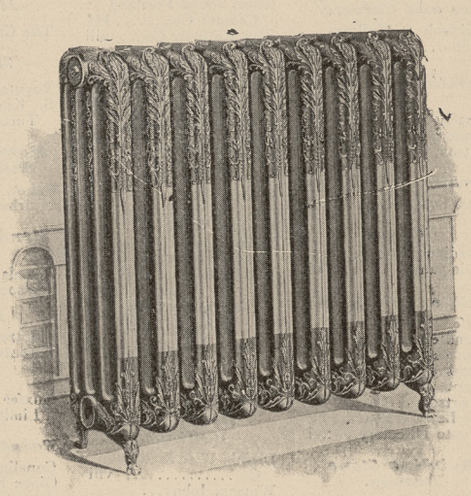
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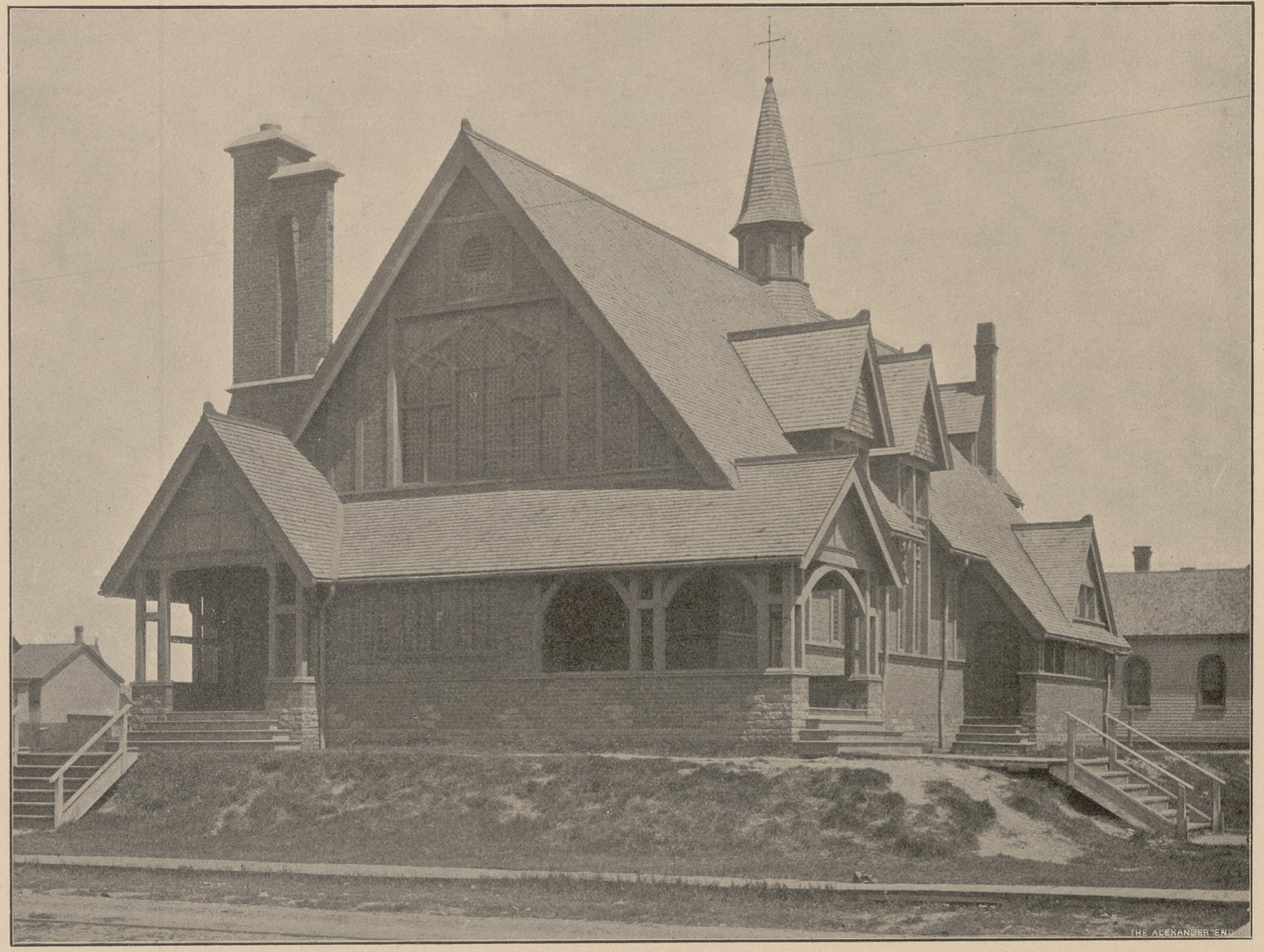
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R. J. Edwards, Architect.

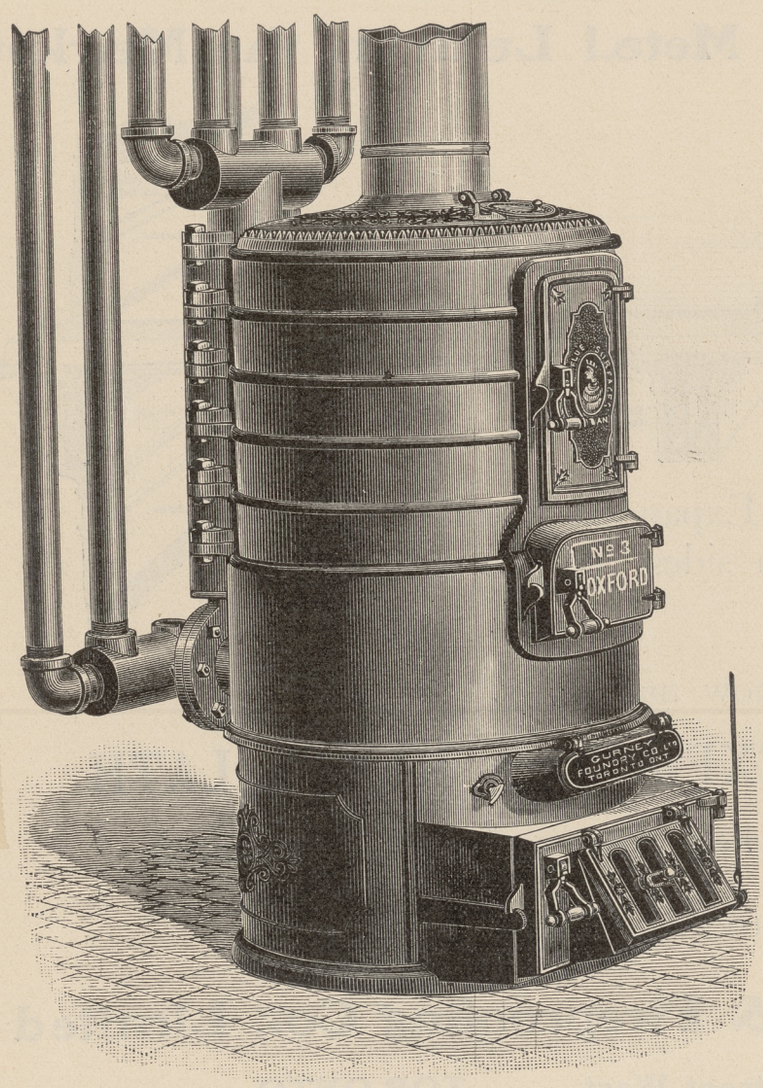
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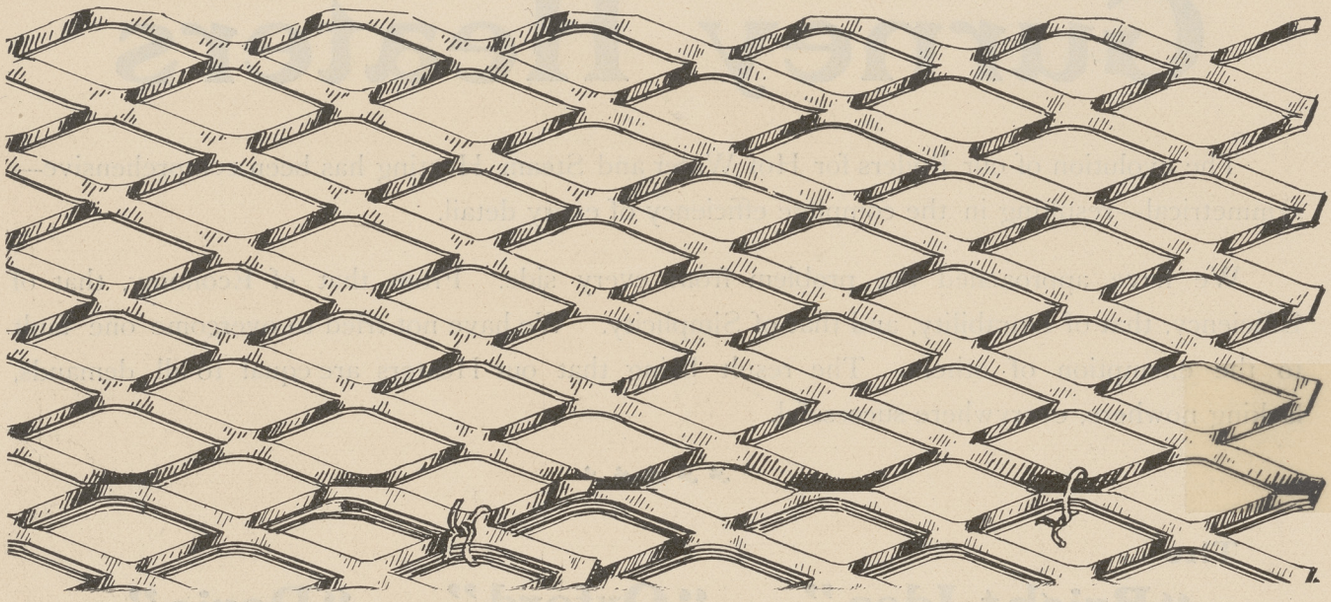
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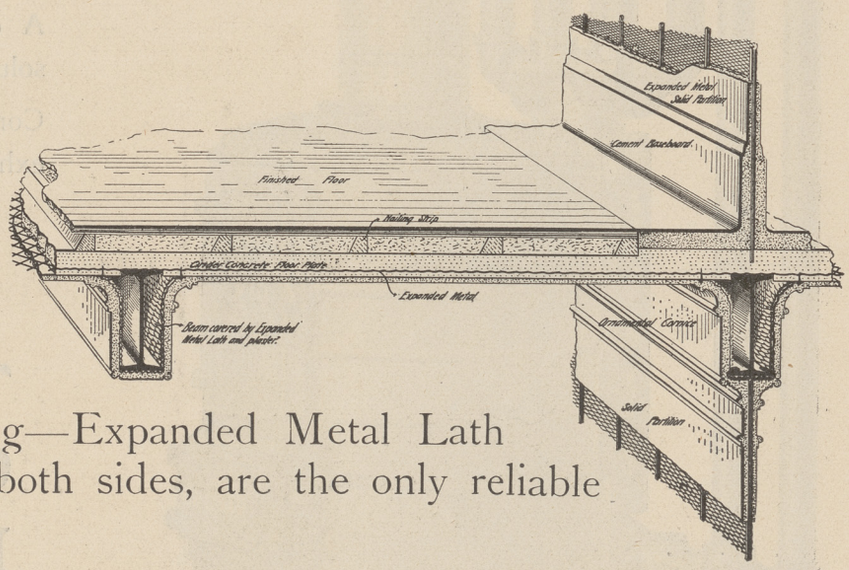
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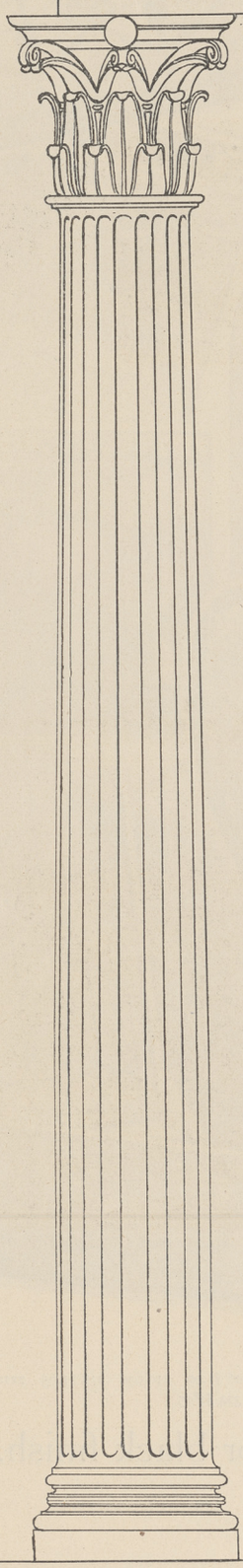
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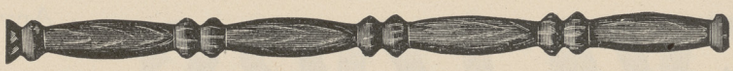
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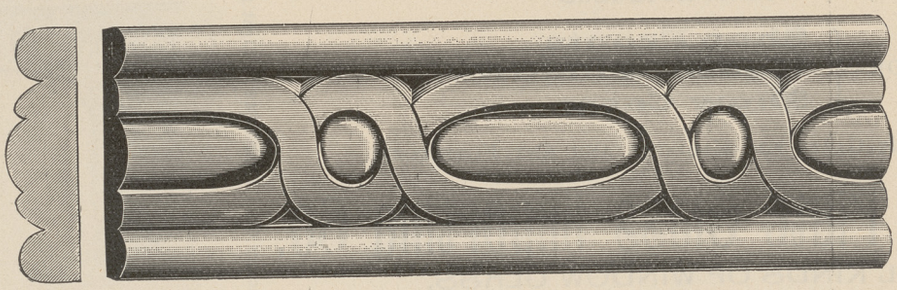
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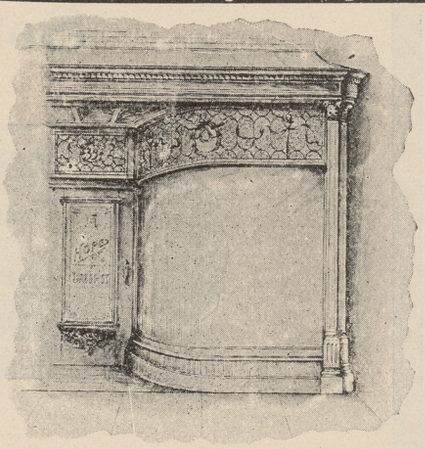
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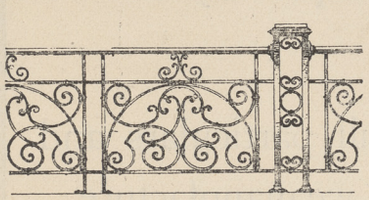
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The Canadian Architect and Builder

VOL. XV.—NO. 169. JANUARY, 1902.

ILLUSTRATIONS ON SHEETS.

St. John's Church (Exterior and Interior) East Toronto—R. J. Edwards, architect.

ADDITIONAL ILLUSTRATIONS IN ARCHITECTS' EDITION.

Photogravure Plate—Entrance to West Transept, St. James' Cathedral, Toronto—Cumberland & Storm, architects.
Photogravure Plate—Fontana di Trevi, Rome—Designed by Niccola Salvi
House on St. George Street, Toronto—Symons & Rae, architects.
House in East Toronto—R. J. Edwards, architect.

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Building in Montreal.

SPECIAL CONTRIBUTORS.

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" W. H. ELLIOTT, of Messrs. Elliott & Son Co., Toronto.
" J. C. B. HORWOOD, Architect, Toronto.
" A. F. DUNLOP, R.C.A., Architect, Montreal

Toronto Building Department

There are signs of an approaching change in the City Commissioner's office in Toronto, and it would be well to consider the question of changing in a fundamental manner the whole administration of building inspection. At the present stage of the city's growth, and even more in consideration of the growth that is coming on, it is important that the Department should be a Department of Architecture, and that the head of it should be an architect highly trained in modern methods of construction, and able to keep up with new ideas. A permanent official of this character, to amend and keep amended the building by-law, and to carry it out intelligently, would be worth a good salary for he would represent great possibilities for the city. It is essential to have a man who is big enough to be at ease under his responsibilities, or the authority given to him will degenerate into a wretched administration of red tape. But if he is big enough he will do much to foster a good class of building in the city.

The Toronto Exhibition

The Exhibition by-law of Toronto having become law, brings into the region of realities the problem of improving the Fair grounds. The argument for the by-law was that a successful Fair is an advantage to the city, and for this purpose new buildings were required. The main building was not rain proof, and the first consideration, which outweighs all others, is therefore plain and practical—to protect the exhibits; and if the building is made fairly presentable, as the plainest and most practical member of the Exhibition Association will desire it to be, so much will have been accomplished, as compared with the present state of affairs, that the Association may reasonably rest from its labors and say that, as the Exhibition did well before, now, with new and improved buildings, it is safe. But the attractiveness of a Fair from the point of view of beauty, which is already accepted as essential to success, does not depend only upon its buildings. Good buildings and large buildings are essential to give adequate motive for the scene, and an imposing background; but the beauty and the real attractiveness of the Fair lies in the way the buildings are placed and the treatment of the spaces between them. Here is a field for the sort of charm that makes the Fair a sort of recreation ground for visitors, who care little about the exhibits. The possibilities are great and varied, and cost, in comparison with the buildings, little but thought. What can be done to improve the grounds as well as the buildings? To hold its own the Fair must meet the taste that has grown up for this sort of thing. It is not really in a safe position if only the buildings are improved. The difficulty is in the number of fixed conditions that exist. But the alterations that are to be made, and in particular the

condemnation of the main building, open up chances that a good landscape designer might turn to good account; and before the ground plan of the Fair is fixed for another period, by the erection of the new buildings, the block plan should be carefully considered by the architects, if necessary with expert assistance. In all important undertakings in which the treatment of grounds is involved, the best results appear to proceed from a joint committee of architects and a landscape architect.

The O. A. A. Convention

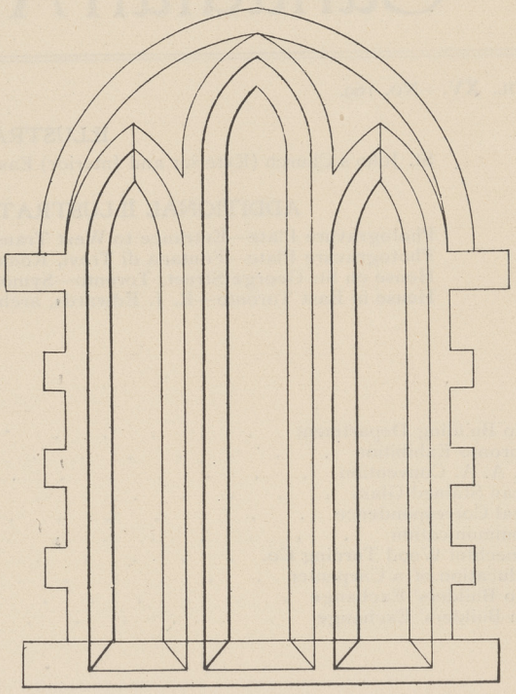
Tne annual meeting of the Ontario Association of Architects was attended, with three exceptions, entirely by Toronto members. The meeting was entirely harmonious and there were indications of increased sympathy with the educational objects, which were a principal theme of the Convention. The Council and Committees have evidently done a good deal of work during the year in arranging the scheme of subject matter and classes, and in actual tuition. The principal lack appears to be in students. The wedding is ready but they that are bidden appear to be not worthy. It seems a pity that there is no power to compel them to come in. If the special committee of the Legislature, which threw out the bill to make membership of the Association the only way to practise architecture had attended the meeting on Tuesday afternoon, they would perhaps think that an Association which has kept on its educational work without the powers it asked for might well have been entrusted with those powers.

There was no doubt nothing altogether new in the papers of Prof. Capper and Prof. Laird. If there had been we should perhaps have had less cause to praise them. They represented the standard ideas of the present time in their subjects; speaking with authority, as men in a position to know, and in a position which requires them to know, what are not only high but practical aims in these matters. They helped Toronto efforts in the way of confirmation and encouragement from without, and the Association did well in inviting others than members of the Association to come and hear them.

AMERICAN STAINED GLASS.

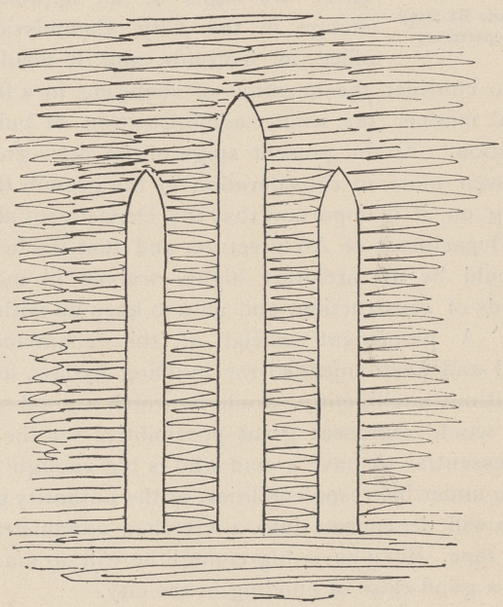
Is American stained glass an improvement to a church? A window has recently been inserted in St. James' Cathedral in Toronto, which raises the question acutely. The disagreeable wall-eyed appearance the opalescent glass gives on the outside is a general objection to the use of American glass, but in the case of St. James' there are particular reasons why, for considerations of inside effect, it should not be used. One of the beauties of this church is the abundant light coming from the aisle windows, which light indeed is a necessity, for the nave seats are dependent upon it.

If the scheme, of which the new north east aisle window is a beginning, is carried out, this characteristic of St. James' will be gone, and we shall have instead an area of gloom provided apparently for the display of a series of illuminated pictures along the sides of the church. The practical discomfort will be intolerable, but it is the artistic loss that is to be most deplored. Any one looking at the church with a seeing eye can even now note the difference between the present effect and a future in the gloom of American glass. The shafting of the columns and the lines of the woodwork are now touched with light from the aisle windows so as to delight the eye. The carving of the cedar organ cases was beautiful under the side light that each received. Now only one is touched with light; the other under the immediate influence of the new window has



lost that charm; indeed the carving is not strong enough to stand the test of dull and diffused lighting.

One can but look forward with regret to the gradual extinction throughout the church of its principal source of beauty. The windows themselves will be among the features which suffer. The glass alone is not the measure of the window. The arch, inside of which the



lancets are grouped, gives the real size of the window, as intended by the designers; and it is essential to the design that there should be light enough to let the relieving arch and its quoined jambs be seen. All this will be upset if American glass is introduced, by the submergence of these details in the general gloom. The windows which it is intended to beautify will

appear unpleasantly narrow, and, the reason for the subordination of the side lancets to that in the centre not being apparent, the grouping will appear to be without reason.

The case is one of conflict between the windows and the church—which is to receive first consideration. The church ought certainly to be the object of consideration, and the first consideration in choosing glass for St. James' Cathedral is that it shall let in light. The only glass that is likely to satisfy the requirement is toned white antique English glass. Figure subjects depending chiefly upon the leading and tones of white, with colour only for emphasis and adornment, would not only shine like jewels in the church and exactly suit its architectural requirements but are eminently suited for sacred subjects. There is something in the pure tints of antique glass, and the necessity for direct purpose in their application, more suited to a religious purpose than the soft and sensuous colours of opalescent glass, and the accidental effects which are a principal object to the makers of American coloured windows. Abundance of colour is in itself no hindrance to religious feeling. The mosaics of St. Mark's are as splendid in colour as they could be made, the robes of Perugino's angels are not only brightly coloured but are lined with another bright colour, and the edges are turned over to show the lining. But in these examples the work is carefully and delicately done to beautify the object to which it is applied. The more pains it receives at their hands the more we receive an impression of serious purpose in its presentation, and the more the subject is exalted. In American work, on the other hand, the subject appears to be but a peg upon which to hang ingenious experiments in accidental effects of colour, procured by manipulating the surface of the glass. The resulting effects—mechanical and accidental—exalt the manufacture but not the subject. The technique is hampering rather than helpful to strong purpose in subject, and, in the American school of glass workers, purpose in subject is not the strong point. The new window of St. James', which represents the descent of the Holy Spirit on the day of Pentecost, seems to be better than usual in this respect, yet it is impossible to avoid feeling that it does not convey the essence of the scene it depicts There is commotion among the Apostles, but it is at something external to themselves. There is not a sign of that possession that required from St. Peter, a little later, the defence that they could not be drunk at that hour of the day. The Apostles have an air of gentle piety, devoutly regarding an apparition ot The Dove, which suggests the source of the tongues of fire that are seated upon them. One of them looks round at his neighbor, which it is impossible to conceive of him doing at that moment.

Mr. Harry Simpson, architect, was a candidate for a seat at the Public School Board at the recent municipal elections in Toronto. Although failing of election, his popularity is attested by the fact that he secured upwards of 1700 votes.

The Central League of School Art of Toronto has decided to purchase five large pictures representative of different styles of architecture, together with a collection of other pictures which will be circulated among the public schools of the city.



Branch Office of the CANADIAN ARCHITECT AND BUILDER, Imperial Building.

MONTREAL, January 17th, 1902.

The building trades in general were perhaps less actively employed than usual last year. Since the great boom of '89 Montreal has not witnessed feverish activity in building. We must take for granted I presume, that a city which has acquired a certain development and has passed the formative period, must count on extraordinary events to create unusual activity. Something like the great Expositions at Chicago or Paris would probably be necessary. As a matter of fact Montreal has but met the wants of the normal expansion of a city of its size since the street widening craze passed, and has not responded to any demands for wild and unnatural expansion.

The year 1901 stands lower in the volume of building operations than many previous years, much lower indeed than the following figures show. In 1889 eighteen hundred permits were granted. Since 1890 a notable decline has been noticeable, 1893 recording one thousand and 1894 five hundred with an aggregate value of $2,750,000; while in 1901 we have 752 permits with an aggregate value of about $2,800,000, being less than any previous year by about 25 per cent. if we remember the weakness of the former reign in the Building Department.

A great many buildings were erected then with total disregard to by-laws add without a permit being taken out, while to-day one has to be taken for a ridiculously small alteration of $30.00 as we have seen this week.

As two or even three inspectors could hardly control all buildings in course of erection in a city of the size of Montreal the new building inspectors upon entering into office established the following system which proved most effective. Every applicant on submitting his plans receives a placard or poster which he is expected to post up in a conspicuous position, together with his permit from the City Surveyor for depositing materials on the street. All policemen on duty report to the head of the district police station any work in progress without the official posters in evidence, which in turn is reported officially by the last named to the building inspector in chief.

We can further explain the steady decrease of building operations on the ground that the city is gradually filling up within its comparative ly limited area. People are forced so to speak to seek accomodations in the

suburbs, such as Westmount, St. Henri, Verdun, Notre Dame de Graces, Outremont, Maissoneuve, Delorimer, etc. The proof of this is in the St. Cunegoude, where we could not find to-day three building lots within the limits of that town proper. This state of affairs has existed for four or five years, with the result that as the last census shows that municipality has hardly increased in population for the last decade.

What should be done at the earliest moment possible is the annexation to the city of Montreal of all those municipalities from Longue Point to Cote Saint Paul, which form an uninterrupted agglomeration of buildings and the whole of which is practically one city to us as well as the foreigner who sees no demarcation whatever between these several towns grouped in one of three hundred and forty thousand inhabitants.

The bulk of last year's work was certainly furnished by last winter's big fire in the business district. It is a great satisfaction to find that in most of the buildings rebuilt an effort has been made to render them less inflammable, the Constine Building for instance, immediately behind the ruins of the Board of Trade, being thoroughly fireproof. A Montrealer returning after a two years' absence would certainly not recognize old historic Saint Peter's street; the two sides having been entirely transformed or rebuilt in the lower part.

Several important buildings were erected which deserve more than a passing glance, such as the new addition to the Royal Insurance Company's building, Place D'Armes Square, seven stories high and costing in the neighborhood of $175,000. In connection with this I am glad of this opportunity to give credit to the architects, Hutchison & Wood, for the respect they paid to the architecture of the past (an occurrence so seldom met with nowadays). The individuality of the old building has been preserved by continuing the new portion on exactly the same lines. In a few years the line of junction will disappear altogether by the change of color of the new stone and make the whole an imposing unity.

The Grand Trunk Railway offices on McGill street, by R. A. Waite, of Buffalo, N. Y., costing $500,000; Carsley's new store on St. James street, by A. F. Dunlop; St. John Baptist church and a $250,000 R. C. structure on Rachel street, by J. E. Vauier; the Merchants' Bank building, additional stories, by Edward Maxwell; the Wilson residence, corner of Sherbrooke and Drummond streets, also by R. A. Waite; and the two princely residences on Drummond street, one in the style of an English manor house, for Mr. R. Reford, of the well-known steamship agency, and the other in the fashionable New York roccoco style, for Mr. Chas. R. Hosmer, of the C. P. R. Telegraph Co., by the Messrs. Maxwell, are among the most important works of the year.

But, unquestionably, the building which has attracted the most interest, is the extension to the Bank of Montreal, now being built on Craig street, at a cost of nearly a million dollars. The structure, which is about 150 feet long, faces also on its long side on Fortification Lane, its axis being exactly in the center of the the present building, extending from St. James street to Fortification Lane. As the slope of the ground is quite considerable from front to rear, (the ground floor on St. James street a few steps higher than the sidewalk), it will necessitate the construction of a bridge over Fortification Lane, uniting the two buildings, the older of which will serve as a vestibule; and a monumental one it will be, with its magnificent facade, unrivalled by any other financial institution.

The slope is such that between the main floor level on St. James street and the level of the sidewalk on Craig street, two stories are gained, which will be devoted to public safety-vaults, the main floor being entirely reserved for the banking room, 40 feet high, with no windows, the light coming from the top. To give an idea of the richness of this structure it will suffice to say that no plastered walls will be in evidence, every inch of wall space being marble, and that the 32 columns of 34 feet in height, supporting the lantern, will each cost the sum of two thousand eight hundred and some odd dollars. The shaft will be in exotic marble and the capital in cast bronze, as in the antique pagan temple of old Rome.

This again is a lost opportunity for our architects, as it has been thought fit, as in the case of many of our prominent modern buildings, to call upon foreign architects to design the structure, Messrs. McKim, Mead & White, of New York, being in this instance the fortunate firm.

The erection of the Foley apartment-houses, on Dominion Square, Metcalfe and St. Catherine streets, by Messrs. Saxe & Archibald, acceuluates a new departure in our mode of living started by the Sherbrooke apartment-house. This structure, which is pleasing in appearance, will cost in the neighborhood of $400,000.

What this year may have in reserve is hard to foretell, but from present appearances, notwithstanding what real estate agents may say, we do not anticipate a season of great activity.

It is true, there are a few other mammoth structures to be commenced in the spring, such as the Liverpool, London & Globe Insurance Co. building, corner St. James and Place D'Armes Square. The building, which will comprise seven or eight stories, was thrown open to competition among a few city architects. Afterwards, it is reported, these architects were advised not to complete their designs, as the work had been given to the makers of the conditions of competition, Messrs. Peabody & Stearns, of Boston.

The Birks Jewelry Store, on Phillips Square, will be enlarged by a considerable addition, Messrs. Hutchison & Wood being the architects.

The Guardian Assurance Company has bought the remainder of the Barron Block ground, adjoining the Lancashire Insurance Company's building, designed by Edward Maxwell, and will build an advertising structure, which, it is hoped, for the profession's sake, will not go out of a Montreal architect's office, in order to give the public an occasion once more to compare results with the American building to be commenced at the same date on Place D'Armes and St. James street.

MONTREAL BUILDERS' EXCHANGE.

The Montreal Builders' Exchange have decided to adopt the system which has prevailed among American Exchanges, of renting desk room to supply firms and allow them to display samples of their materials in cases, the object being to make a permanent exhibit of building materials within the Exchange, and at the same time to increase the revenue.

MONTREAL MASTER PLUMBERS' ASSOCIATION.

The Association held its annual meeting a fortnight ago, when the following officers were elected: Hon. president, John Date; president, Thomas Moll; first vice-president, Thomas O'Connell; second vice-president, Joseph Thibault; third vice-president, W. G. Graham; secretary, J. A. Gordon; financial secretary, J. C. Brunet; treasurer, Captain Giroux; English corresponding secretary, J. W. Hughes; French corresponding secretary, Ald. Jos. Lamarche; chairmen of committees: Sanitary, P.C. Ogilvie; Audit, J.A. Watson; Apprenticeship, P. J. Carroll.

INTERCOMMUNICATION.

[Communications sent to this department must be addres ed to the editor with the name and address of the sender atta hed not necessarily for pub ication. The editor does not hold himself responsible for the expressions or opinions of correspondents, but will, nevertheless, endeavor to secure c rrect replies to queries sent in. We do not guarantee answers to all queries, neither do we undertake to answer questions to issue following their appearance.]

Fro n "Bowmanville": I am about to build several brick buildings, and the owner does not wish to use pressed brick, but desires to have the work done nicely, and the color of mortar to harmonize with the bricks. I have the privilege of using either red or cream coloured bricks. How can I make coloured mortar that will not fade with age? Any hints that may help me will be appreciated, and may be of service to other contractors who may be in the same condition as I am placed.

ANS.—If the bricks used are light coloured, light or cream mortar may be in harmony, but for dark red or purplish coloured bricks, white or cream joints are oppressive to the artistic eye, and it is better to use a dark mortar of some kind, preferably the same color as the bricks. By a judicious assortment of the bricks and harmonious choice in the color of mortar, a skilful bricklayer could so vary the shades of his brickwork that an otherwise plain building would have quite an artistic appearance and one that would

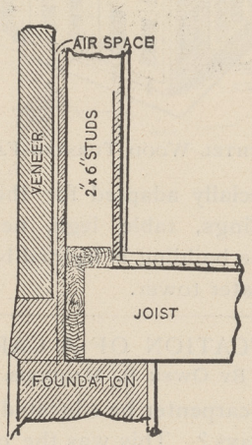


FIG 1.

last for ages. To make a dark mortar, and one that will last, use furnace ashes and lime, pulverize the ashes. Pounded red bricks or red tiles, mixed with lime, make a fine red mortar; cheap mineral colours may be mixed in with the mortar to intensify the colours. It is likely, however, that it will be a matter of economy to purchase prepared mineral mortar colors, as these may be obtained now through any reputable hardware store. Perhaps, by varying the colors of both bricks and mortar on the same surface, in accordance with a pre-conceived plan, a fine and novel effect could be produced.

From "Builder."—How high is it safe to build a chimney above a roof, without "staying" with braces?

ANS.—With the data furnished it is somewhat difficult to decide this question; however, we may give a few general rules. The pressure of the wind may be taken as proportional to the square of the velocity with which it travels, and when it impinges on a plane surface. It is known that a velocity of 35 miles an hour produces a pressure of 6 lbs. per square foot of surface directly opposed to the current; with a velocity of 70 miles an hour the pressure is 24 lbs. per square foot, and at 105 miles an hour the pressure is 54 lbs. per square foot. The highest velocity on record is that of 121 miles an hour, which produces a pressure of 72 lbs. per square foot. If then, for example, a chimney-stack is 10 feet above a roof, and it contains 3 flues each 9x14 inches placed end to end, so that the

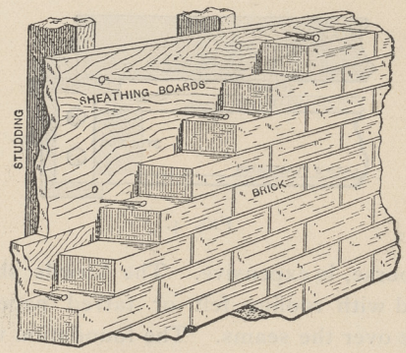


FIG. 2.

stack is 18 inches thick and 5 feet wide; then we find by taking "moments" of the forces about the base of the stack, that a gale of wind blowing at the rate of 58 miles an hour—a common velocity—and producing a pressure of 16¼ lbs. on every square foot, would overturn the stack on its base. If the flues are placed side by side and the stack is 2 feet thick and 3 ft. 9 inches wide, it would require a pressure of 26½ lbs. per foot to overturn it, or a velocity of wind amounting to 73½ miles an hour. The pressure of the wind on an octagonal or a circular shaft is less than that on a square one of the same diameter, that on a circular or cylindrical shaft being two-thirds of that on a square one; and the pressure on an octagonal shaft is four-fifths of that on a square shaft. The resistance, however, is less in the circular and octagonal shafts on account of their being a smaller quantity of material used in their construction. The above calculations are based on the supposition that the shafts are perfectly plumb and upright, but if a shaft is at all "off

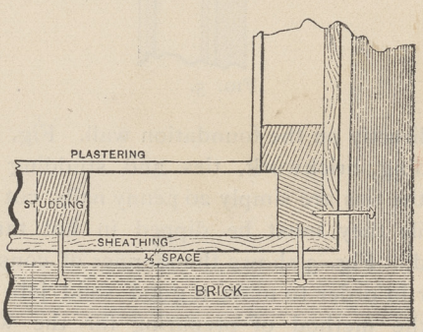


FIG. 3.

the plumb" it will offer much less resistance to the force of the wind.

From "Contractor."—I desire to get some information regarding the proper way to build a balloon frame and prepare it for brick veneering, and am particularly anxious to know how the work is finished under the eaves. Will you kindly help me out, and if not asking too much, give a few sketches as to how the work should be done?

ANS.—The first requisite is a good solid stone foundation of hard bricks, with a stone sill course dividing the foundations from the upper work. The

building proper should be framed just as any other balloon building is framed. The studding may be 2x6 or 2x4 inches, set 16 inches centres, if the walls are not to be lined with boards inside. If they are, then studs may be set 2 feet from center. It is better to line up with boards both the inside and outside, but

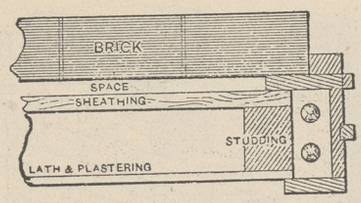


FIG. 4.

this, of course, is expensive. The boards should then be covered with roofing felt or tarred paper, stayed with laths over the seams. The foundation walls must be made thick enough to admit of the joists resting on them, also the frame-work of sills and brickwork, as shown in Fig. 1. The method of construction is very fairly shown in this diagram and may be followed with safety. It will be seen there is an air space left between the bricks and the tarred paper, a very desirable condition. In this diagram there is shown a stone plinth, but this is not necessary, as the bricks

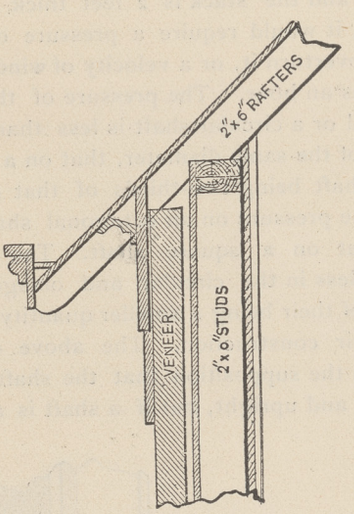


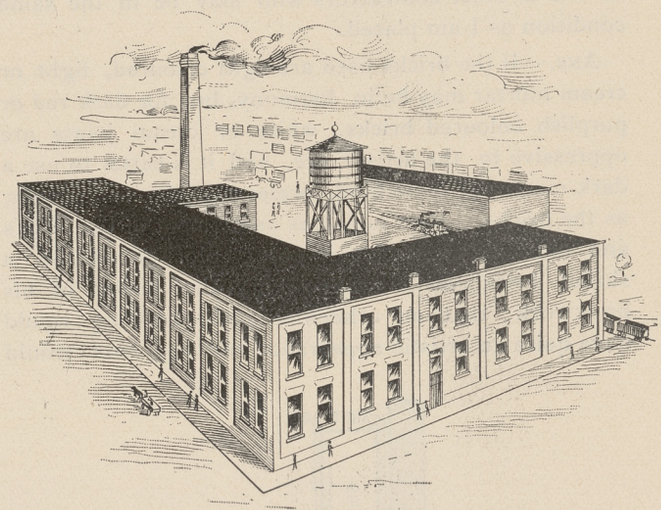
FIG. 5.

may restdirectly on the foundation wall. Fig. 2 shows the boarding, brickwork, ties and studding in perspective; the ties are simply 20 penny nails, cut nails, or if wire nails they must be dipped in hot tar before being used. Fig. 3 shows the manner of constructing the corner in order to make a good solid job. Fig. 4 exhibits the method of preparing for the windows, showing how to form the sash weight boxes and window and door reveal. The manner of finishing under the eaves is shown in Fig. 5. Though there are many other ways of finishing at this point, this is about the most economical and efficient. Floors should be laid double, the first floor formed of sound common lumber, dressed, then all the plastering should be done, base laid and other work done, before finishing floor is laid. Hardwood flooring, good and dry, should be laid in kitchen, and in any other room not intended to be carpeted.

The Federated Building Trades Council will memorialize the Dominion government to compel plumbers to hire boys on the apprenticeship system.

THE S. KNECHEL WOOD TURNING COMPANY

A new and completely equipped factory has recently been put up at Southampton, Ont., by the above company. The building is of brick with a frontage of 100 feet and depth of 160 feet, giving a floor space of 24,000 square feet. Its arrangement is well shown in the accompanying illustration. It will be seen that the Grand Trunk Railway has run a siding into the company's yards, thus allowing the lumber being unloaded direct from the yard to the dry kiln, as well as of the finished material from the factory being placed directly on the cars. A well equipped machine shop is connected with the factory. The machinery is



S. KNECHTEL WOOD TURNING FACTORY.

all new and specially adapted for the production of embossed mouldings, table legs, newels, balusters, spindles, etc. The building is lighted by electricity and protected by a water tower.

THE EDUCATION OF A CARPENTER.

BY OWEN B. MAGINNIS.

How should a carpenter be educated, and how is it possible now-a-days? This was the question put to me a short time ago by a gentleman whose son showed an inclination to use tools, and desired to become a carpenter. It took me a long time to answer it; but he decided by the reply, and will put the boy through the course. The following is the substance of what I told him, and I submit it for the benefit, suggestion and criticism of all carpenters of experiecce, for they will surely be able to add something to it:

As to age, though it is claimed that the younger a boy adopts his occupation the quicker and better he will learn, still it would not be judicious to have him leave school and go to work before sixteen, or fifteen at the earliest. Not that I believe it impossible for one younger to become adept and skillful, like Lamartine's Claude, "The Stonemason of St. Point," who, by self-denial and using his father's tools, had reputation and could earn his own living at seventeen. There are many boys above the age of twelve who go out to labor, and achieve great success before they reach twenty. Even considering this, it would be better to wait until the boy had acquired sufficient schooling, and is well enough versed in the necessary teachings to use them if called upon; for inability to read, write or cypher correctly may perhaps prove a barrier to complete success in after life. School-time past, the boy should be indentured to a reputable master, or be plac-

ed at a school or institution where trades are properly taught.

Here arises the question as to how he should be taught.

Formerly apprentices commenced at the very foot—that is to say, they did the chores or simple tasks which are part and portion of carpentry. For instance, he turned the grindstone, swept out shavings, picked up nails, ran errands, carried material, melted glue, etc. By this means he gradually acquired knowledge of shop routine and learnt names of objects, tools, appliances and stuff. This is an excellent start, and, in my opinon, should be still continued, for the reason that every youth should be acquainted with and have a knowledge of what he will handle and manipulate before he commences to do so. At the end of three months he might go to work at the bench, practice sharpening edge tools, planing, sawing and nailing, the use of the tri-square, jointing, gluing and other simple operations. These, being primary and important, must be learnt properly and thoroughly; otherwise good work cannot be executed.

Here I would impress the absolute value of due and careful attention being paid to ingrafting rudimentary principles in trades, especially in the carpenters' trade. These form, as it were, the foundation or basis of the art, and, if not sufficiently acquired, will always be wanting to the workman and cause in him a regret that he be so imperfect in them, and a recriminating thought that his teachers had been incapable may also arise. Therefore, they should be well and correctly inculcated into the mind of the future mechanic.

Most boys look upon this time as more or less of a playtime, when they may learn and play. This is not objectionable, and to me it seems natural and consequent with the exuberant spirits of youth, but they must not be allowed to idle or be lazy, as this would be deleterous. If a boy wants to rest or converse, let him talk to the men while they work; but keep the subject of conversation on some detail of his occupation. If one is to succeed at anything he must be interested in it and really like it. It is not enough that his occupation is to be the means of giving him a livelihood; there must be more than this, namely, real interest in the desire to acquire skill and mastery. Every youth, who desires to become a good workman, will have this feeling, and every successful man, as a rule, is and has been an enthusiast in boyhood. While the future mechanic is learning to work correctly with his hands practically, he might be advantageously instructed at night in theoretical carpentry. This can be done by his attending night-school during the winter months, or by self-instruction through good books at home. I regret to say that such useful teachings as the theories of trades are rarely to be found taught in night-schools, even in the great cities. If they are taught at all it is by general form, as "Applied Mechanics." This method is, to my mind, too theoretical to be useful and too general to be applied practically.

One thing, however, should be taught in every school, so that all future tradesmen may be instructed in it, and that is drawing. I cannot overestimate the value of this indispensable adjunct to every carpenter's education. It is simply the keystone of his guaranteed success, and should it be lacking, he will, as an uncompleted arch, be inadequate for his work.

To learn to draw is to learn to think, to reason, to be accurate, to be neat, to be attentive and to conclude tangibly and intelligently. A knowledge of drawing is like all other knowledge, a power; for it enables the young mechanic to comprehend the ideas formulated by a more highly educated mind than his, in order that he may create in wood shapes, forms and constructions.

When a boy is in the shop or working outside, it is always advisable to entrust him, to a certain extent, with important work. This gives him responsibility, and also adds dignity, with a sense of timidity and care in doing it. When one is doing routine work he is liable to grow careless or indifferent, and the work entrusted to a learner should improve in character with every piece satisfactorily completed.

As a moral suasion in the shop much depends on this. Good treatment is absolutely necessary to the forming of every boy's personal character. I do not mean that the usual discipline of the shop should be relaxed or varied, or that special privileges should be allowed learners, as this would be injudicious and possibly erroneous. What I do mean is that the efforts of the beginner, be they ever so crude or ineffectual, ought to be encouraged, and his mind instructed and trained to do right. Perseverence is often rendered difficult—aye, sometimes impossible—in the face of ridicule or for want of encouragement, therefore consideration should modify reproof, and an incentive to persevere be given to those who are seemingly dull or languid.

Determination will often make a youth become an excellent workman, in spite of all sorts of hindrances; but difficulties are obstacles to be surmounted, and should be removed from the path of him who desires to learn, that he may become more apt, more fit, and more accurate. In concluding these few general principles, allow me to suggest the advisability of instructing our modern apprentices and young workmen in the science of machinery. Woodworking machines are now used in almost all shops of any pretensions, and will, owing to the increased facilities and rapidity of action they give, be more extensively used. The knowledge of how to use machines, I now know, enters largely into the price a modern carpenter is paid, and in a little while no one will be able to get a job unless he can operate some machine, for the days are coming when machinery will supplant handwork to a greater extent than it has already done. All observing carpenters realize this, and it is therefore of paramount importance that the future generation of mechanics be versed in their manipulation.

TORONTO BUILDERS' EXCHANGE.

The annual meeting of the Toronto Builders' Exchange took place in the offices of the Association, Yonge St. Arcade, on January 20th. The meeting was largely attended by representatives of all branches of the trade, together with supply merchants. The President, Mr. Thos. Christie, presided. The financial statement was most satisfactory and was duly adopted.

Mr. Jno. M. Gander, the representative of the Exchange on the Technical School Board, gave an interesting report of the working of that institution.

Mr. H. Martin, representing the Exchange on the Industrial Exhibition Board, also gave a report of his term of office.

The Exchange decided to adopt the plan of daily

Exchange meetings from 11 to 1 for the purpose of transacting business between members.

The following officers were elected for the current year: President, Jas. B. Thomson; 1st Vice President, Jos. Russell; 2nd Vice President, R. G. Kirby; Treasurer, David Williams; Directors, Thos. Christie, Jno. M. Gander, Jas. Crang, Jno. R. Lyon, Wm. Smallwood; Auditors, Geo. Clay and Fred'k Holmes. Mr. Thos. Christie was elected to act upon the Board of the Industrial Exhibition, and Mr. Jno. M. Gander was re-appointed on the Technical School Board.

LONDON BUILDERS' EXCHANGE.

The fourth annual meeting of the London Builders' Exchange was held in the Exchange rooms on the 20th inst. A large number of the members were present, and all were well pleased with the standing of the Exchange as shown by the reports of the officers.

Officers for the ensuing year were elected as follows: President, Mr. D. C. Simpson, 422 Rectory St.; 1st Vice President, Mr. John Nutkins, 721 Elias St.; 2nd Vice President, John Whittaker, 551, King St.; Secretary-Treasurer, Geo. S. Gould; Directors, Messrs. Thomas Jones, W. Tytler, Ald. S. Stevely, Ed. Martyn and Geo. Young.

A CONTRACTOR'S MEMORY JOGGER.

A few days ago, writes Edward Hurst Brown, in the Painters' Magazine, I was in the office of a large firm of painters who do a great deal of new work, and are constantly figuring on all important jobs in the architects' offices in their city. The member of the firm who makes up the estimates had on the wall, back of his desk, a blackboard, made on a novel plan. A sheet of ground plate glass about four feet wide by two feet high had been fastened to the wall, the roughened side out, with a narrow trough at the bottom for slate pencils and eraser. Before the glass had been put up the back had been divided by narrow white lines into sections, as shown by the sketch, which has been reproduced, and after the white lines had thoroughly dried, the entire back was given two coats of black and afterwards varnished, in order to preserve it from dampness. This made a blackboard on the principle of a child's drawing slate, which would stand any amount of wear and tear, and could be written on with a soft slate pencil or white crayon, and might be easily cleaned. On this board the name of every job on which estimates had been asked, together with the date when they were wanted, and name of the person or persons to whom the bids were to be sent, was entered. If invitations had been received from a number of builders, all the names were written in the appropriate column. If the bid was to go to the architects, their name appeared. If the owner asked for the figures, his name alone was mentioned.

By referring to this blackboard, a glance would indicate what was to be figured on. As soon as a bid is sent for any job, the letter "S" is written boldly across it, this being omitted, of course, if for any reason the firm did not care to figure. There is no chance to forget all about an invitation that you particularly desired to respond to, and let the time for sending in your bid go by. Just consider a bit and figure for yourself whether a memory jogger such as this would not pay for its cost many times over in the course of a year.

DATE	JOB	WANTED BY	DATE	JOB	WANTED BY	DATE	JOB	WANTED BY
12/27	M E Orphanage	J. Plane & Co J. B. Scott & Son A. M. Hammer	12/30	3 Houses at Elm Grove	Doyle & Co. J. Plane & Co A. M. Hammer	1/4	Parish Bdg St. Luke's Ch.	P. N. Sill & Bro
12/27	Store & 3 Main	J. Square & Co	1/2	Hotel at Milltown	J. Square & Co	1/4	Row of houses Church St.	R. S. Tate & Bro
12/27	523 Queen St	J. Plane & Co. P. A. White	1/2	Office Bdg. 334-6 Main St.	P. A. White J. B. Scott & Son J. Plane & Co A. M. Hammer			
12/28	St John's Church	Rev. J. B. Lee	1/2	Baptist Home	Dr. Jenkins			
12/28	15 Ry Armory	Col Bell	1/2	537 Lake St	M. B. Jones			
12/28	Repainting 721 Richard	Mrs Smith	1/3	Business Blk. Edgar Ave.	J. Square & Co			
12/30	Genl Hospital	Dr Sawbones	1/3	J. B. Fuller & Co. Factory	P. N. Sill & Bro			
12/30	Railroad Sta.	Engr. M. W.	1/3	7th St. Bridge	County Clerk			
12/30	3rd St. Bridge	County Clerk	1/4	417 Wood St	Doyle & Co J. Plane & Co			

CONTRACTOR'S MEMORY JOGGER.

THE INSPECTION OF BUILDINGS AND SCAFFOLDS.

The Federated Building Trades Council are urging the appointment by the City Council of Toronto of a civic inspector of scaffolds, and the City Commissioner is said to have promised to recommend that such an official be appointed. The knowledge of their legal liability is sufficient to ensure care on the part of most, if not all contractors in the construction of scaffolds. There is therefore good reason to doubt the charge of carelessness in this particular which has been laid at their door by the Trades Council. On the other hand there is no doubt about the fact that in their own interest, as well as that of the workmen, contractors equently find it necessary to urge upon their employees the exercise of greater care in constructing and using scaffolds. The appointment of a scaffold inspector would probably fail to meet the case. A single inspector could not properly perform the duties, and the cost of several inspectors would be out of proportion to the risk. If there were two inspectors of buildings they should be able to greatly improve the supervision of constructional work and incidentally look after the proper construction of scaffolds.

UNIVERSITY TRAINING IN ARCHITECTURE.*

By PROF. S. H. CAPPER, McGill University, Montreal.

There are various architectural topics that are the subject of perennial discussion, according as one's view leans, with natural bias, to one side or another in matters essentially many-sided.

"Whether architecture is a profession or an art?" is such a topic; upon it discussion—nay, controversy, both bitter and prolonged, has raged interminably; and, in England at any rate, even serious division of council has resulted, with somewhat dissipated energy and hampered action for a time as a natural consequence.

Closely allied is the question of the proper training for an architect during his period of preliminary studentship;—what course will best fit him to do his best? It is a question, I venture to think, of somewhat vital concern to us in Canada. At present, as a people, we are neither very wealthy nor very powerful; we have not yet worked out our scheme of national education at all completely; it is not yet established, as it should be, broad and harmonious, on really national lines; on the contrary, to one coming but newly from Europe, it seems in too many ways seriously provincial in spirit and narrow in result. On the other hand we have across the border-line a great nation for our neighbour, both powerful and wealthy, eager and resolute, and bent, it seems to me, on solving the problem of how to place the maximum of education and special training within reach of all. Those visitors to our meeting who have honoured us by coming from across the border, and whom we all most cordially and gladly welcome here to-day, will not, I am sure, misunderstand me, when I urge the need for our doing our uttermost, in honourable, friendly rivalry, to maintain our own position worthily alongside our greater neighbour and to strengthen our determination not to be out-distanced in that race, the goal of which is national life lived worthily, and the highest development of the intellectual life of all.

In Toronto and in Montreal we have now in Canada two schools for the training of architects. Of the former I naturally do not venture to speak in detail, standing in the presence of many who know it well and can speak with an authority in regard to it that I cannot claim. But I do not doubt that I am right at any rate in this, that in both we are still at the stage of "missionary effort" in our endeavour to promote the thorough training of young architects in the Dominion. Too often our voices are but as those of one crying in the wilderness, where there are none that listen and whence architects do not come forth. In Toronto I do not know exactly how the matter stands at present, but in Montreal, during the five years that I have been at McGill University, encouragement and discouragement have been fairly evenly commingled. Personally, however, I have had the deeply interesting experience of organizing from the beginning and planning out the lines of development for what will, I trust, prove a sound and stimulating school of training in architecture on broad university lines of education.

In so many-sided a field as architecture, which is, it seems to me, an art and a profession, both, and (perhaps) something more besides, there is room for many kinds of activity and many types of mind. To one the solution of problems of construction, with the extraordinary wealth of mechanical resource at the disposal of the modern constructor, is the side of architecture that appeals most strongly; to another, it may be rather the problems of social interest, the housing of the poor, the proper provision for the care of the sick in hospitals, or even the progress of sanitation and the realization of its laws and their requirements; to some it is the nice adjustment of plan and interior arrangement; to others it is the wider field of the composition and design of buildings as a whole and the joy of seeing thoughts take concrete form, as they are realized in actual execution.

It is significant, this many-sidedness of architecture, and justifies in a measure its claim to be at once the broadest of the arts and the foundation of the rest. It brings the architect into touch directly with almost all the other arts, professions and handicrafts, from sculpture and painting to law and medicine and to industries of very many sorts.

And the training for the architect must be broad to correspond, if he is to be adequately fitted for his work. It cannot, of course, prepare him to the extent of endowing him with all the knowledge in all the branches that he may, in the course of his practice, require to master and make use of; that is out of the question; but it should lay the foundation for such acquirement by training the mind to grasp readily the dominant factors in the problems that ask for their solution in well-balanced and harmonious architectural design.

Of the many and varied qualifications that go to make the successful architect in practice, some are of the distinctly practical type, such as business aptitude, faculty of organization and attention to practical detail, while others are as distinctly of the theoretical and academic type; most notably is this true of power in design. Between the two comes construction and engineering, leaning now to the more practical, now to the more academic side, according as it is the more ordinary, rough-and-ready, customary building, or the altogether higher work in calculation and design of the scientific constructional engineer. That this last requires mathematical and scientific training, and is a fitting subject for university instruction, surely needs no argument or proof. The enormous advances made in but recent years in modern steel-construction especially are, I suppose, for the most part the direct result of such scientific study and research. But, if we accept this main rough division into the two sides, the practical and the academic, for the former class let it be at once conceded that the best preparation is the actual stress of daily work at the office desk and the experience that is only to be gained by study at first hand in closest touch with buildings in course of actual execution. Nothing can ever take the place of such practical training, which must always remain an absolutely essential part of the preliminary equipment of an architect. No plea for academic education is ever intended to lose sight of this; nor is it the case that for this practical training academic education is either specially adapted or required. But, while those who urge so strongly that your architect must be "a practical man" are not at all beside the mark, that contention by no means covers the whole of the ground of an architect's education; it does not touch what is after all, if I may be allowed the phrase, the truly architectural side of architecture.

It is doubtless in the ordinary relations of life—though I am not quite sure that I ought to qualify the relations of architect and client as always "ordinary"—a matter of great personal convenience to be on this eminently practical footing, obviating friction and promoting smoothness that may almost be prosaic. Heaven forbid that I should not fully endorse the eminent desirability of being "a practical man."

Even the staunchest advocates of practicality, however, will admit that a great monument of architecture is not to be measured ultimately by the business capacity of its designer, but by some other and higher quality altogether. Jacopo Sansovino is said to have miscalculated the roof for the famous library of St. Mark's at Venice, and to have spent a time in jail as the result. While languishing there he doubtless came to hold a very exalted appreciation of the practical advantages to an architect of being practical; but we, and the many thousand travellers who know nothing, perhaps, of Sansovino's piteous time of incarceration, for whom the library of St. Mark's is one of the buildings that make the Renaissance architecture of Venice so fruitful and delightful a study, are apt to think less of the "practical man" than of the brilliant artist and designer, who has left us so impressive a monument of his genius and skill.

The pre-eminent quality of architecture is in truth design, and this power of design is the vital touchstone of the greatness of an architect. It is in virtue of design and composition that the great buildings of the past, differing utterly, it may be, in point of architectural style, yet, one and all, appeal to us in varying degree. Historical associations may, of course, affect us greatly; other considerations, too, may have to be allowed for in our appreciation; yet architecturally appraised all buildings owe their fame, in chiefest measure, to this power of composition and design. The same is true of our modern work. It stands to reason, therefore, that anything that will foster and quicken power of design must tend to the best equipment of an architect for his life's work.

For design, I venture to claim that academic training is the surest road for most, at any rate, to the achievement of success; that in no other way can the student readily obtain the grasp of the subject, the breadth of view, necessary to attain to the best use of the power that may be his. Design is the expression given to a building; if consistent, convincing and harmonious, the building will have dignity and the incomparable quality of Style. Slip-shod designing will mar any building and make it commonplace and lacking in distinction. With design, then, the architectural student's preparation should begin, and with design it should continue to the end, not (of course) to the exclusion of other necessary studies, but in conjunction with them. Design, it seems to me, should form the basis, the backbone (so to speak), of his course of study from the earliest moment possible, and around it the rest of his subjects should, so far as possible, be grouped. And I base my plea for university training for architects precisely on the ground of the pre-eminent importance of training in design and upon the special facilities a university course affords for carrying out such training consistently in fullest measure.

Nay, I do not hesitate to go still further and to argue that the chief objection usually urged against academic preparation for professional life, the objection, namely, that it is "unpractical," is not in itself a disadvantage in this particular connection. In studying out an architectural design, in developing his ideas so as to bring out of them the best result he can, the student must, at the outset, at any rate, be left as little hampered as possible by fettering limitations, such as, economy of cost, restrictions and inconveniences of site, etc. The object of his study is to teach him to think architecturally and to express his thoughts suitably and with grace of diction in the language of his art; to mould them into forms that shall be purposeful and fitting as well as beautiful and gracious.

It is by no means an easy alphabet to learn; like any other language, if I may pursue the metaphor, it takes long to master; it means no short apprenticeship in grammar and expression; for the artistic faculties are slow of development sometimes and always require careful, even toilsome, training. My contention is that for such training no preparation, as a general rule, is more apt or better than that provided by an university course of education. It can offer a well-arranged and systematic scheme of education, such as cannot readily be equalled by any other training. Moreover, it can and does most especially develop the study of design, that being precisely the side of architecture that most lends itself to academic teaching; it thus lays special stress on what, in my view, is the central subject, the foundation of the whole, while it is precisely the subject most difficult of adequate and serious study under ordinary conditions, apart from such a systematic course. It cannot be acquired in ordinary office

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training, where a student, be he never so willing, can at best but "pick up" desultory fragments of the subject. In a busy office each assistant is bound to have his special work allotted to him, without reference to his own requirements as a student; or, if he be a beginner, all around him are too anxious to have him show that he can be of some use to them, to think of his own immediate studies as the matter of first importance to himself. Travel and study are an alternative, but I do not think they are of the most effective service till a student has both learned what to see and how to see it; and both these require the previous training which systematic study of design can best give.

As against this academic instruction, it has been urged that such a course of training will stifle genius—a charge which need not, I think, be very seriously refuted; no sincere education can so fail of its primary object, namely, to "draw out" the faculties and develop them, as to succeed in stifling the superior powers that we call genius—and, secondly, that it will tend to create a dead level of correct mediocrity, dull and wholly lacking the freshness of untrained spontaneity. This, too, appears to me hardly to need refuting. The efforts of untrained spontaneity are not generally, I fear, much more successful in design than in painting or in sculpture; in architecture they too often lead to a wholly unregenerate straining after originality, that appeals successfully neither to reason nor to good taste. And academic training fully justifies itself, if it succeeds in making mediocrity less wayward, controlling its vagaries, and sparing us those frantic abortions in design that remain a lasting instrument—potent for evil—in vitiating public taste.

I would not be thought for a moment to speak slightingly of originality; no gift can be more precious. But originality in architecture is not to be attained through the medium of blatant disregard of accepted forms of architectural expression. It is rather, it seems to me, to be attained more modestly, by absolute sincerity in design, coupled with, or rather dominated by, that rare gift, the imaginative power that naturally expresses itself in form or composition that is beautiful, not ugly. The French use the phrase "voir en beau" or "en laid," to express this faculty, or its opposite. One man will "see," or realize to himself, a design under a form that naturally lends itself to beauty of line or mass or composition; in the hands of another, on the contrary, the same idea will be embodied under forms that are less pleasing, artistically not satisfying. But I cannot think that the former will risk any loss to this admirable faculty, if he seek to educate his powers along the lines I have endeavored to suggest; while the latter may at least have the asperities of diction modified by familiarity with established and well accepted forms.

Perhaps few great architects have shown more striking originality in design than Sir Christopher Wren, in the wonderful series of churches with which he enriched London during nearly half a century after the great fire of 1666. Of them all the great cathedral of St. Paul's is assuredly his master-piece, I suppose the most beautiful and imposing church that the Protestant faith has raised. Yet, in its final form, it is a triumph of academic discipline over daring, but not successful, amateurish spontaneity. Those of you who are familiar with the design as originally approved—in King Charles I's warrant, it is declared to be "very artificial, proper, and useful"—will recall the really grotesque design for the central dome. "A nightmare conception," it has been called, "of two domes and a telescope steeple". It is even surpassed in grotesque extravagance by an earlier scheme of Wren's for the reconstruction of Old St. Paul's, in which a dome was to be "surmounted by a huge open-work pine-apple, 68 feet high, of monstrous and horrible design". Yet the dome of St. Paul's, as actually erected, is one of the most beautiful in existence, its most conspicuous characteristic being, as has well been said, "its magnificent sanity."

The reason for this astounding aberration of Englands's greatest architect is, probably, simply the lack of academic training. Wren entered upon the practice of architecture as an amateur, and, genius though he was, he never wholly overcame this lack of preparation for his great career; in St. Paul's itself, for which the long series of London churches was Wren's very wonderful preliminary study-ground, there are still minor blemishes in spite of years of patient study—it is idle to deny them—that seem only the result of this want of training in classical design.

Originality does not then, I take it, imply departure from traditional forms in architecture so much as honest, unaffected and gracious use of them in sincere application to the requirements of modern building. Hence it is said that I do not give my adhesion to these who would try to cut themselves adrift from the architecture of past times in order to be "modern." Not from ignorance, bnt from full and critical knowledge of the past can we create a tradition for the present.

It is idle to seek to evoke a "modern style" in the sense in which "Gothic" or "French Renaissance" were styles at different periods of French architectural history, when builders—both designers and workmen—were all familiar with certain current forms and methods and were restricted to these alone. With our immensely fuller knowledge, we cannot be so restricted, if we would. We can express ourselves in many ways in solution of the same problem, whereas in earlier times one, current, way only of expression was known and, therefore, consistently practiced. And modern architecture gains in this immensely fuller vocabulary, so to speak, if wisely, not extravagantly, used.

The historical study of architecture consequently forms the natural basis for architectural design. Only by knowing the best that has been done can we do the best that can be done to-day. Study of architecture in the past should not, if rightly guided, lead to mere archæological copying or repetition in our work to-day; but it should, if its lessons are properly learned and its teaching taken truly as our inspiration, bring home to us the best that the past has done and set before us an ideal that will serve us as both a standard and stimulus to solve our modern problems as honestly and well. Only out of full and loyal knowledge of past tradition can we to-day hope to achieve in our work results that will be as true and as expressive of our modern life.

In the course in architecture which I have had the privilege of planning out and developing at McGill University, I have sought to give effect to this conception. The full curriculum embraces four years, of which the first is preliminary, devoted chiefly to Mathematics, Physical Science and Drawing, with the very useful addition of practical instruction in the workshops, designed to impart some knowledge of the nature of materials of construction, to familiarize the student with the more important tools, and to give him some manual skill in their use. Only in the second year is the more special work in the different departments of architecture and engineering begun with us.

I need not dwell upon all of the work in detail; I apologize for intruding myself upon you in this direct way. I desire only to emphasize the main conception that has guided me in the organization of the architectural course.

In the first of the three remaining years the teaching is chiefly devoted to a rapid survey of architectural history from ancient Egyptian to modern times, touching successively upon the great eras of European civilization and tracing the evolution of architectural styles in their constructional forms and methods.

The student is thus placed in touch, so far as may be, with the broad lines of his subject, and the present is linked with the past in continuous development. This, it seems to me, should have an important influence on the student's attitude; for, fascinating though the archæological side of architecture may be, it is not as archæology but as architecture that the modern student should regard it.

In conjunctlon with these historical lectures, a course on the elements of effect in architecture and the main principles underlying the two great divisions of architectural style, the classic and the gothic, naturally, I think, arises; for want of a better name I have called it Elements of Architecture. And from the first, so soon as the student has acquired a little familiarity with the more obvious means of architectural expression, such as the Classical Orders, (which remain, I think, the best primer, so to speak, the most reasonable and effective introduction to architectural form), he is set to express himself in elementary design of plan and building.

In the next year the historical course is devoted to a study in detail of the architecture of the Renaissance down to modern times, in amplification of the earlier general course, while both third and fourth year students take together the more special courses. These comprise detailed study of ecclesiastical, domestic and public architecture, the lectures still dealing with the historic evolution of architectural styles and with the problems and requirements of modern work. A course is also given upon general art history, so as to place the architectural student in touch not only with the decorative details of the different styles of architecture, but also with contemporary forms in other branches of art, especially the decorative arts employed in building.

I have only mentioned the subjects bearing on design, as the central theme round which, in my opinion, architectural study can best be developed in an university course. I have perhaps spoken at too great length already of the work of my own department at McGill University; if so, I again apologize. But I have said scarcely anything of that other side of architecture, construction, for which the scientific training of an university course offers very direct and effective preparation. For modern construction in its more recent progress touches engineering in its completeness of calculation and in its accuracy of design. And again let me guard against the charge of disregarding the practical training needed.

In an university course it is not possible, nor is it attempted, to supersede that side of training for professional practice which is only fully to be gained by practical employment in office and on works. This, the more business side of professional work, must always be learned in actual employment under the conditions obtaining in everyday life. And such practical knowledge of the work before him should, whenever possible, be acquired by the student concurrently with the higher training the university offers, by seeking, during his free months, employment in connection with works in operation or in progress of execution.

This training is manifestly of the greatest importance for the complete equipment of the student. But, necessary as this practical training is, an university course can and does provide for something more, for a thorough grounding in the principles upon which professional practice is ultimately based, an education which can hardly ever be otherwise at all adequately acquired but which, though too often lacking, is essential for attaining the best and highest work in architecture. In design and composition—the key note of the art of architecture—success depends for the most part on the due training of the critical aesthetic faculties; and for such training the education offered in an university course is very directly and specially adapted; for most, the surest; for many, the only road.

I have limited this paper to the consideration of but one side of academic education; I have had but time to mention the other, the training on the mathematical and engineering side which is so important a factor in the modern very wonderful development of constructional engineering; the consideration of

this, of course, should have, to do it justice, separate treatment at hands more competent than mine; nor have I ventured into the wider domain of the consideration of general university education, and its power to develop and broaden on harmonious lines the intellectual gifts and sympathies, and to quicken the mental life and strengthen its fibre. All that is beyond the scope of such a paper as mine to-day, which has already detained you, perhaps, too long.

Let me conclude, having thus in a sentence suggested these wider bearings of my subject, with a quotation from one of Oxford's greatest sons which sums this up in words far more eloquent than mine: "A university training is the great but ordinary means to a great but ordinary end; it aims at raising the intellectual tone of society, at cultivating the public mind, at purifying the national taste, at supplying true principles to popular enthusiasm and fixed aims to popular aspiration, at giving enlargement and sobriety to the ideas of the age, at facilitating the exercise of political power and refining the intercourse of private life." Is there any one of these great ends that should not be also the gaol of our profession, the aspiration of us all as architects?

Mr. Gouinlock: I am sure we have all listened with a great deal of pleasure to the instructive paper given us by Professor Capper of McGill University. I heartily approve of the wisdom of the Association in inviting Professor Capper to give us a paper, which I am sure will stimulate the student and the profession at large. I have much pleasure in moving a vote of thanks to Professor Capper for his very able paper.

The motion was seconded by Mr. Denison and carried.

Principal Hutton, of the University of Toronto, who was in the audience, after expressing the pleasure of the outsiders who had come to listen to Professor Capper's address said: Professor Capper said that he would not refer to the advantages that Toronto University offers for the study of architecture because we all knew them so well, but I should like to tell Professor Capper that one of the advantages for the study of architecture is unique. As Mr. Blake said many years ago "the government put up the University Building to show the public how to build, and in case the public would not then know to build, they later put up the School of Practical Science to show the public how not to build. (Laughter.) Speaking as an outsider again, I cannot help feeling that the practical side of architecture occasionally needs some little consideration. I have heard my friends tell of an architect who requiring to put a register into a bed room could not find any place where it could be put but under the bed. (Laughter.) I have also heard it said that the Society of Architects would not be perfect until they had thrown their doors open to women. I am really a little surprised not to see any here to-day, (cries of "O no," laughter.) I know there are a large number of ladies who are very anxious to show how they can build, and I am sure that women would see that plenty of pantries were put in a house, and that a window would not be put in where it would be impossible to get at it.

Professor Capper: Had the architect who built a house with a bed room in it in which you could not place a bed, an academic training?

Principal Hutton: I believe this particular architect had not an academic training. Those who suffered from his ministrations would probably be strong supporters of Professor Capper's views; but I am inclined to think that the part of Professor Capper's paper which would interest them most would be the account of Sansovino's misadventure. They would look back with regret to a time when, if an architect proved incapable, the municipal authorities were able and willing—to clap him into jail. (Laughter.)

Mr. Wright: Mr. chairman and gentlemen, I for one would like to add the expression of my appreciation of the paper which we have just heard from Professor Capper. He has covered the ground very completely, classifying the work of the student under satisfactory heads. The paper deals principally with the questions of design and scientific construction as they should be taught in our universities, while leaving the practical application to be studied by work in an office. If Professor Capper will glance through the course as laid out by this Association, he will see that we have taken very much the same view of the subject as he has. Our Association during the past year has done a good work in organizing this course, and it will do a much better work if it succeeds in carrying it out. The difficulty which we have had in forwarding the purpose of this Association throughout the province is that in the matter of the study of professional work the young men have been beginning in the wrong way. The mistake I think is in the admission of students to professional work; they have in the past been admitted too early in life and at too low a stage in their education. It has been the effort of the Association to raise that standard and it is to be hoped that their efforts will meet with success. The difficulty as far as the younger member is concerned is not so apparent to him at the time of registration, but it becomes more apparent when he comes to practice, and in the matter of guidance in this respect we have in the past not done our duty—if we have failed to require from our applicants a rigid fulfilment of the conditions necessary to qualify as students of the Association.

Mr. Hynes: (visiting member of 18 Club). It seems a unanimous opinion that a university education is desirable for an architectural student, and the question is, how are we to get the students to take advantage of this course. I think perhaps in Mr. Wickson's report there is something that is antagonizing the idea of the University course. That is the apprenticeship system. It is very hard to tie a man to two things. I think that persons who have a little money they wish to dispose of might establish two or three scholarships for the students to strive for in the University, which I think might induce students to take this course.

Mr. Symons: I should like to say a few words with reference to our educational committee. I think Professor Capper said that after all it was the design that gained distinction for an architect, and we give comparatively little credit to the man who has constructed the building in comparison to that given the man who has designed it. I think that we all agree that the men who have reached the highest stage in architecture have reached their height by their distinction in design. My own feeling has been for years that efficiency in design can only be obtained by academic training, by being thoroughly trained for that work, learning the A, B, C of the Orders and so on till we learn to design truly and well. Some people have asked me, what would you recommend to a young man as a course of training in architecture? Now-a-days we certainly make the answer that we can recommend a university training. And though it is sometimes hard for some of us to say whether it is the best, yet the longer I live I am the more ready to say it is the best, and I do not think we are dealing fairly with those who come asking admission to our offices in taking them in. We must be very careful that we are not sacrificing their interests simply to gratify our own pockets, to get them to do our work. Those of us who have gone through what we have, and in whose younger days there was not the chance of these days, must confess that our lacking is wholly I might say on account of our not having had the chances of academic training. (Applause).

Mr. Burke: Mr. President, I have great pleasure in adding my word of testimony as to our appreciation of the paper we have had from Professor Capper. Mr. Symons has touched on the difficult point with reference to architectural education, in Ontario at any rate—the tendency of students to enter an office without or before taking a proper architectural course in the School of Science. That tendency or custom can only be remedied by the architects refusing to take students who have not taken this course. The portion of our work to which Mr. Hynes referred in Mr. Wickson's report, is simply a method of getting over the difficulty with men who are now students; we feel that they should have some advantages, and it is for their benefit that arrangements have been made whereby they may have about seven hours per week at the School for lectures

on the scientific courses in connection with the Association curriculum.

Mr. Langton: Professor Capper's paper has the evangelistic quality which is most valuable in a lecture or paper. One cannot, in the short time that can be occupied by a paper, do much definite teaching, but one can stir up a spirit that will forward the end in view in delivering the paper; and this I think Professor Capper has done. There few of us I fancy who have reached, or are approaching middle age, who do not at this moment regret that the present advantages for students did not exist in our time and that we must be content with being—architects like Wren. (Laughter). The first necessity for architecture now-a-days is training. In the old days architecture was a craft. The architectural conception was common property; and to carry it out in individual cases, all the designer required was to know the grammar of its detail. The case is different now. The number of different works comprised requires a scientific training and the architectural problem is an open one, to be solved only by a mind cultivated to flexibility by exercise in the fields of thought of all generations of architects. Nothing can accomplish this training but long, continuous and practical study. That is the reason for the stand the Association takes. That is the reason for the apprenticeship system. One learns to play the flute by playing the flute. Students don't know that so much education is necessary and that so long a practical training is necessary. They see people set up as architects without it and they think they can do the same. But we know it, and it is our duty to students to lead them, not perhaps as they want to go, but as they ought to go. We have improved our curriculum and our methods. We have taken in good part all the advice the Eighteen Club, as representing youth and modern thought, gave us. We have rooms and facilities. We only want students. We have not got the students we ought to have and I am afraid in some cases they are being kept from us. I think this ought not to be the case. The architect, of whom Professor Hutton spoke, who put a bed over a register and windows in out-of-the-way places, was not an architect in the true sense of the term—in so far as he did these things. I think also that the case of Sansovino's roof is exceptional. It is a commonplace among architects that the architect who is an artist is also a good constructor. An architect is not a mere designer of exterior appearance. In my own mind I separate the word designer from the word architect. Architect is an inclusive term. The architect conceives the building as a whole. The plan is at the bottom of everything and a plan is not a plan that is not conceived of as a thing to be built. The best architect is the best builder.

THE BEHAVOIR OF STEEL UNDER STRESS.*

By Prof. C. H. C. Wright, School of Practical Science, Toronto.

While discussing with one of the members of the Council of this Association the results of certain experimental work of the post-graduate year at the School of Practical Science I was induced to promise a paper on the behavior of steel under stress and in its preparation I have kept in view the younger members and students of the Association.

Inasmuch as the use of steel has completely revolutionized methods of construction and plan, its effect should be and is apparent in the design, not however, to the extent the material deserves. It has been the custom for years to use rolled shapes, rivets, and joints of an engineering type partly because this branch of the work has been generally relegated to the engineer, and partly because most of the steel work is hidden. Is not much of it hidden because it is considered unsightly? Why should not the parts exposed to view be æsthetically treated and the shapes receive architectural attention.

It has always been considered necessary to study carefully the properties of other building materials. The successful treatment of granite shows boldness or vigor; marble, delicacy or refinement; sandstone, elaboration; terra-cotta, repetition, etc.

While steel has been used very largely during the last decade it will be used much more extensively in the immediate future. It becomes desirable that the members of our profession should, and imperative that the younger members shall, observe closely the peculiar properties and behavior of this important material in order that it may be treated satisfactorily in design as well as in construction. It ought not and cannot be left to the engineer.

Another difficulty that might be mentioned is the action of fire on steel. Serious as this difficulty is from the point of view of design, it must be met frankly and not forgotten that this very same property enables it to be rolled and worked into shapes economically.

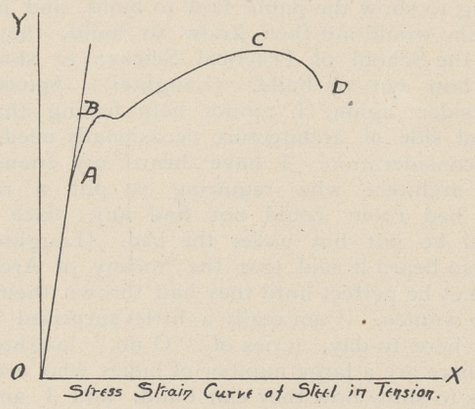
Interesting as this line of thought is, we must turn our attention to the more elementary stages and consider a few of the properties of steel.

Suppose a steel rod (usually 24″ long) is placed in a testing machine and a load applied so as to produce tension in the rod. Now if measurements of the lengths of a part of the rod (usually 8″) are made it will be found that for every load applied or stress there is a corresponding change in length, a deformation or strain. Further, that when the load is removed the rod will regain its original length.

There is a point however beyond which this is not true, or where the deformation or strain is not constant for equal increments of load or stress. Below this point steel is elastic, while beyond it is plastic. The point at which this change occurs is called the elastic lim t. If however a piece of steel be stretched (strained) beyond the elastic limit, and the load removed, it will contract more or less but will not regain its original length.

The measurements of deformation or strain, which must be accurate to the nearest 1-10,000 of an inch, are made with an extensometer of which this Riehle Yale represents a very satisfactory type. As will readily be seen, the points of the screws which fasten it to the specimen are held rigidly 8″ apart. After fastening it to the specimen, the bar connecting the two heads is removed, and the two micrometers read or set at zero (the contact being determined by the ringing of an electric bell on the closing of the circuit by the contact). A load is next applied to the specimen, and the micrometers again read, the difference between the two sets of readings, giving the deformation or strain corresponding to the load or stress. If the stress be doubled the micrometers will show that the strain has been doubled. As the stress is increased it will be found that equal increments of load will produce equal strains so long as the steel remains elastic, or in other words within the elastic limit.

If these measurements were continued and the resultant stress strain curve drawn, plotting the loads as vertical ordinates, and the strains as horizontal abscissa, it would resemble O A B C of the accompanying figure.



Stress Strain Curve of Steel in Tension.

In the complete curve there are four significant points, viz., the true elastic limit, A; the appa rent elastic limit, B; the ultimate strength, C; and the breaking point, D. From O to A the ratio of stress or strain or load to deformation is constant and the curve becomes a straight line. Between A and B the ratio of strain to stress increases slightly, while at B a very marked change takes place, hence the term "apparent elastic limit." Micrometer measurements of the length are not necessary to determine this point, and consequently it is widely used in commerce, and is often spoken of as "the commercial elastic limit," or often merely "elastic limit." Beyond the elastic limit the material continues to increase in length as additional loads are added until it reaches its ultimate strength, when it begins to fail. It no longer continues to support the load, but stretches under a decreasing load and finally separates under a greatly reduced one such as is indicated in our diagram by the point D.

Specimen No. 1 is a mild steel made by the open hearth process and gave the following results when tested in tension. The length of the specimen was 24 inches and its diameter 1″.015. Punch marks one inch apart were made along the rod. The specimen was then placed in the testing machine and subjected to tension. The load was gradually applied and the material elongated uniformly for a time until it reached a point where it stretched under a constant load of 21,000 pounds, i. e. the commercial elastic limit of 21,000 ÷ (1.015x3.14159) i. e. 21,000 divided by the cross section of the rod or 27,200 pounds per square nch. The rod finally broke under a load of 37,700 pounds or of 37,700 ÷ (1.015x3.14159) or 47,200 pounds per square inch of its original cross-sectional area. On measuring the distance between two of the punch marks originally 8″ apart (4 on each side of the break), it was found to be 11.08″ long, i. e. the

*Paper read at the annual meeting of the Ontario Association of Architects, Toronto, January, 1902.

steel had an elongation in 8″ of 38.5%. Collecting we have :—

Commercial elastic limit.....27,200 pds. per sq. in.
Ultimate strength..... .....47,200 " "
Elongation in 8 inches.....38.5%

The following measurements made on this specimen will show perhaps more clearly the elasticity of the material.

Load in Pds.	Stress in Pounds per sq. inch.	Extensometer readings.	Deformation of Strain.
1,000	1237	8.0005	0.0005
2,000	2474	8.0009	.0004
3,000	3711	8.00125	.00035
4,000	4948	8.00160	.00035
5,000	6185	8.00195	.00035
6,000	7422	8.00225	.0003
7,000	8659	8.0026	.00035
8,000	9896	8.00295	.00035
9,000	11133	8.00325	.0003
10,000	12370	8 00355	.0003
11,000	13607	8.0039	.00035
12,000	14844	8 00425	.00035
13,000	16081	8.00455	.0003
14,000	17318	8.0049	.0003
15,000	18555	8.0052	.00035
16,000	19792	8.00555	.0003

On drawing this stress strain curve, plotting the stresses as vertical ordinates and the strains or deformations as horizontal abscissae we get the following diagram.

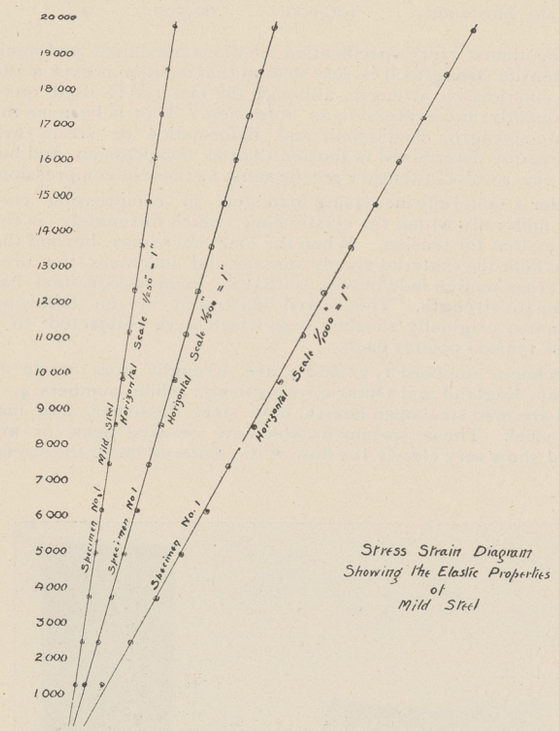


FIG. 1.

The complete stress strain curve is given in Fig. 2.

Specimen No. 2 of Milo Steel, made by the open hearth process, gave the following results in tension:—

Length of specimen,.....24 inches.
Diameter of specimen,.....1.015 inches.
Apparent Elastic Limit,.....27000 pounds per square inch.
Ultimate strength.....47500 pounds per square inch.
Elongation in 8 inches,.....38.0 %

Load,	Stress in Pounds per Square Inch.	Extensometer Readings.	Elongation.
0	0	.27135	
1000	1237	.27185	.0005
2000	2474	.27235	.0010
3000	3711	.27265	.0013
4000	4948	.27290	.00155
5000	6185	.27325	.0019
6000	7422	.27355	.0022
7000	8659	.27395	.0026
8000	9896	.27430	.00295
9000	11133	.2746	.00325
10000	12370	.2749	.00355
11000	13607	.2753	.0039
12000	14844	.2756	.0043
13000	16081	.27585	.00455
14000	17318	.27655	.0049
15000	18555	.57655	.0052
16000	19792	.2769	.00555

Specimen No. 3 mild steel made by the Bessemer process gave the following results in tension :

Length of specimen.....24″
Diameter of " 1.0155
Apparent elastic limit.....29,500 pds. per sq. in.
Ultimate strength .....46,400 " "
Elongation in 8″ 40%

Load.	Stress in pds. per sq. in.	Micrometer Readings.	Elongation.
		.5578	
1000	1229	.5581	.0003
2000	2457	.5586	.0008
3000	3685	.5591	.0013
4000	4914	.5595	.0017
5000	6145	.5599	.0021
6000	7371	.5602	.0024
7000	8600	.5606	.0028
8000	9828	.5609	.0031
9000	11050	.5612	.0034
10000	12290	.5616	.0038
11000	13510	.5620	.0042
12000	14740	.5624	.0046
13000	15970	.5627	.0049
14000	17200	.5629	.0051
15000	18430	.5632	.0054

Specimen No. 4 of machine steel gave the following results in tension :

Length of specimen..... 24 inches
Diameter of specimen..... ..... 1.014
Apparent elastic limit.. .....
Ultimate strength.....100,600
Elongation in 8 inches 16 5%

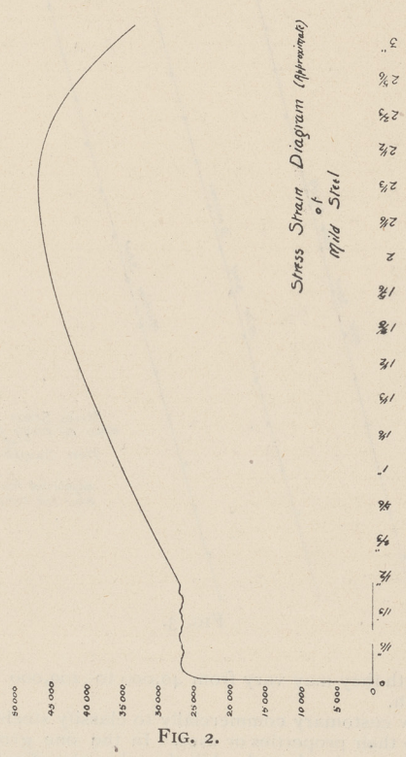


FIG. 2.

Load.	Stress in Pounds per Square Inch.	Extensometer Readings.	Elongation.
1,000	1273	.3837	.
2,000	2547	.3840	.0003
3,000	3820	.3844	.0007
4,000	5093	.3848	.0011
5,000	6366	.3852	.0015
6,000	7640	.3856	.0019
7,000	8913	.3860	.0023
8,000	10190	.3864	.0027
9,000	11460	.3868	.0031
10,000	12730	.3872	.0035
11,000	14010	.3876	.0039
12,000	15280	.3879	.0042
13,000	16550	.3883	.0046
14,000	17830	.3887	.0050
15,000	19100	.3890	.0053
16,000	20370	.3894	.0057
17,000	21640	.3897	.0060
18,000	22920	.3901	.0064
19,000	24190	.3904	.0067
20,000	25470	.3908	.0071

Figure 3 is the stress strain diagram of specimens Nos. 2, 3 and 4 within the elastic limit. Allowing for reasonable errors of observation the line joining the plotted points is a straight line showing conclusively that steel is within these limits perfectly elastic.

Before looking at the classification of steel let us examine very briefly its composition and process of manufacture.

Cast iron as you will remember is a combination of from 2 to 6

per cent. of carbon with iron. The large amount of carbon determines its characteristic features or behavior. Wrought iron is the product resultfng from the removal of carbon from cast iron. This leaves with the wrought iron such impurities as sulphur and phosphorous. When these are present in too large quantities they render the iron red short or cold short respectively.

Steel is a combination of iron with a percentage of carbon varying from minute quantities to as high as 2%. It is manufactured in the three following ways. viz.—1. By adding carbon to wrought iron—the product of such process being known as crucible steel. 2. By removing carbon from cast iron—the product of this process being known as Bessemer steel. 3. By melting together cast and wrought iron—the product of this process being known as open hearth steel.

Cast iron is hard and brittle and can be moulded, while wrought iron is soft and ductile and can be welded. Steel is unlike wrought iron in that it is fusible, and unlike cast iron it can be forged, and with the exception of high grades it can be welded. In addition to these advantages the higher grades can be hardened and tempered.

The term steel is applied to a class of materials which cover a very wide range of properties. One particular grade may be soft and ductile while another is quite hard and brittle. In tensile strength they may vary from 40,000 to 200,000 pounds per square inch.

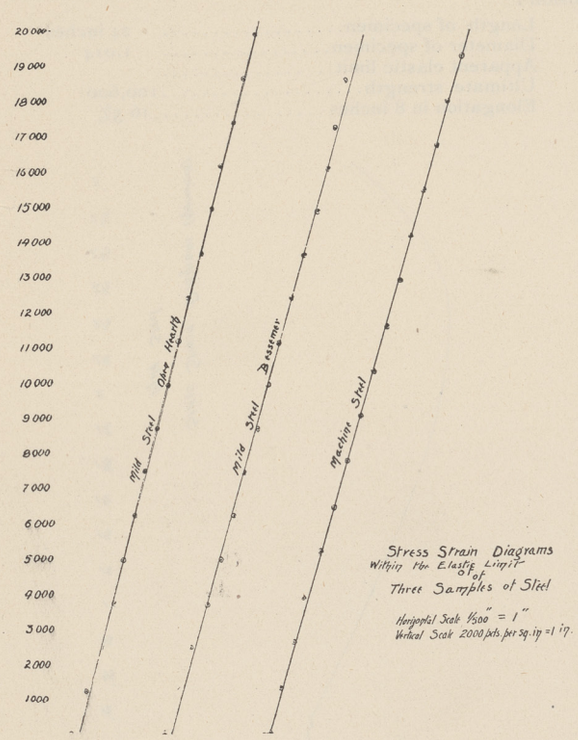


FIG. 3.

It is now customary commercially to classify steels either according to their properties or uses. In the one group there is mild, medium or hard steel, while the other classification includes rivet steel, boiler plate, structural, machine, tool and spring steel, etc.

The following table gives a few of the characteristic physical properties of these different classes :—

Rivet steel should be ductile rather than strong and should have an ultimate strength of 40,000 to 55,000 pounds per square inch ; elastic limit, 30,000 to 45,000 pounds per square inch; elongation in 8" = 25 to 35%.

Boiler plate—Ultimate strength 50,000 to 65,000 pounds per square inch; elastic limit, 30,000 to 45,000 pounds per square inch; elongation in 8" = 25 to 30%.

Structural steel—Mild, ultimate strength 40,000 to 55,000 pounds per square inch ; elastic limit,25,000 to 35,000 pounds per square inch; elongation in 8" = 25 to 35%.

Medium—Ultimate strength, 55,000 to 70,000 pounds per square inch ; elastic limit, 35,000 to 45,000 pounds per square inch, elongation in 8" = 20 to 25%.

Machine steel—Ultimate strength, 80,000 to 110,000 pounds per square inch ; elastic limit,55,000 to 70,000 pounds per square inch ; elongation in 8".

Tool steel and spring steel—Ultimate strength, 120,000 to 200-000 pounds per square inch.

The standard specifications for structural steel proposed by a committee of the American Society of Civil Engineers in 1896 is as follows :

	Lbs. per sq. in.
" Tensile strength low steel	60,000 + 4,000
" " medium	65,000 + 4,000
" " high	70,000 + 4,000

Elastic limit 55% of the ultimate strength of the specimen.

$$\text{Per cent elongation in 8 in.} = \frac{1{,}500{,}000}{\text{Ultimate}}$$

$$\text{Per cent reduction of area} = \frac{2{,}800{,}000}{\text{Ultimate}}$$

Rivet steel when heated to a low cherry-red and quenched in water at 82° Fahr., must bend to close contact without sign of fracture. Specimens of low steel when treated and tested in the same manner must stand bending 180° to a curve whose inner radius is equal to the thickness of the specimen, without sign of fracture. Specimens of medium steel as cut from the bars or plates and without quenching must stand bending 180° to an inner radius of 1½ times the thickness of the specimen, without sign of fracture. While those of high steel also without quenching must stand bending 180° to a radius of twice the thickness of the specimen without sign of fracture."

In connection with the latter part of this specification the following test may be interesting and instructive.

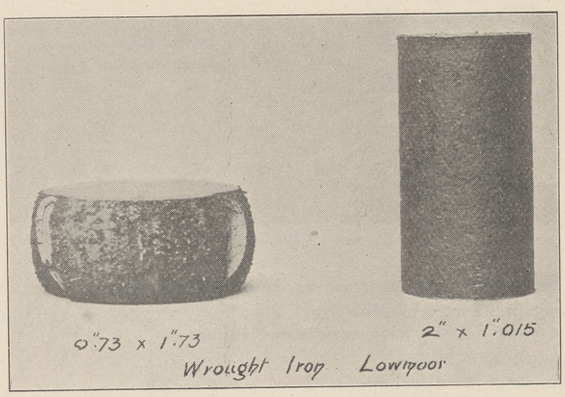
Two specimens, one of mild open hearth and the other of machine steel were heated to a cherry-red, quenched with water and tested with the following results :

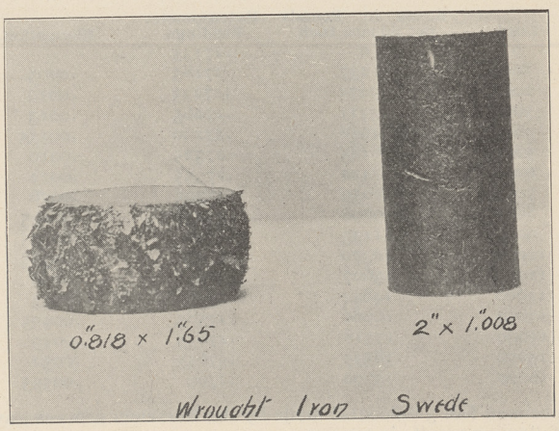
	Ultimate strength pds. per sq. in.	Elastic limit pds. per sq. in	Elongation in. 8"
Mild steel	47,200	27,200	38.5%
Mild steel hardened	62,200	43,000	broke in strips
Machine steel	83,900	55,600	21%
do hardened	106,000	60,500	2%

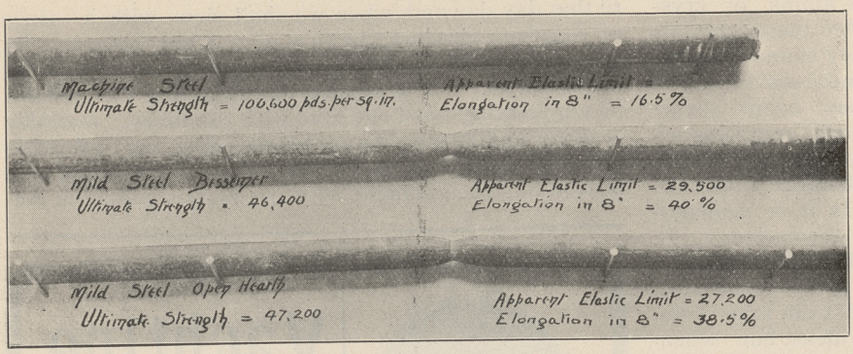
While almost every specification mentions maximum and minimum tensile strengths it is very seldom that mention is ever made of the compressive strength, although the material is used quite as frequently in compression as in tension. This is because the ultimate strength, elastic limit and deformation or strain are more readily determined in tension than in compression, and because the results in tension are the same as those in compression.

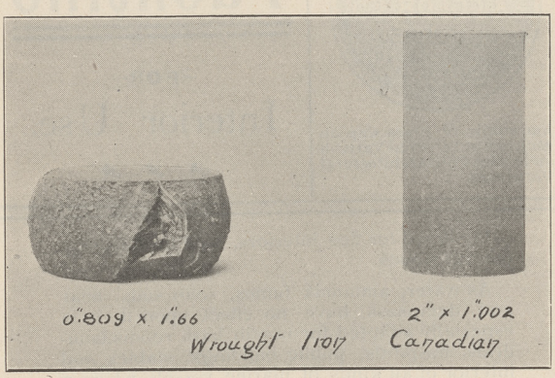
Under a uniformly increasing load steel in compression contracts uniformly within the elastic limit, which fortunately is the same as that for tension. When the load increases beyond the elastic limit the material simply spreads and increases the area of its cross-section indefinitely, so that in compression steel has no ultimate strength. This is well illustrated in the following specimens, originally 2 inches long, which were subjected to a load of 170,000 pounds each.

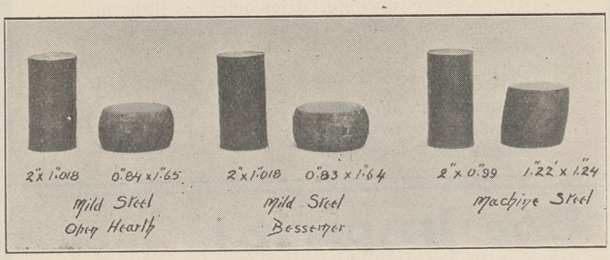
Specimens numberd 1, 2, and 3, are wrought iron, made in Sweden, England and Ontario respectively; while numbers 4, 5 and 6 are mild steel open hearth, mild steel Bessemer, and machine steel. Those specimens which are cracked open or are etched show very clearly the flow of the material under the stress.







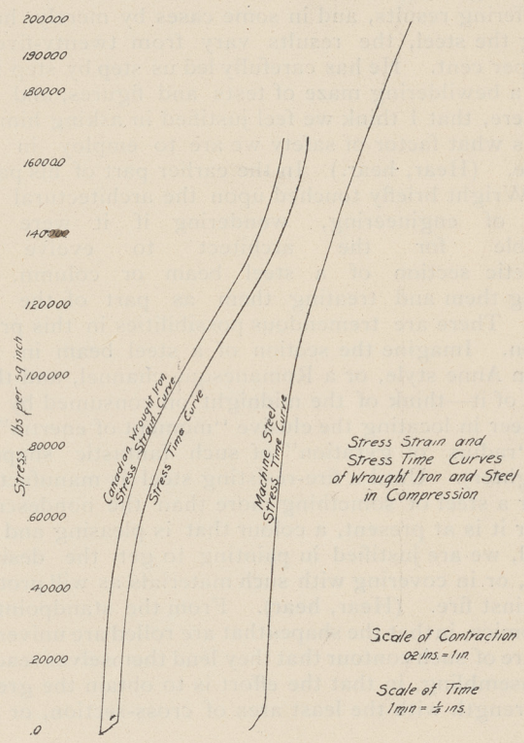




The stress strain diagram for steel in compression when the stress is determined by dividing the load by the original cross-sectional area is as indicated in the annexed diagram, FIG. 4.

These compressive tests were made on a Riehle 200,000 pounds machine, and as the screws were kept running at a uniform rate, a set of readings of the times required to produce the stresses were registered on a chronograph simultaneously with the measurements of the deformation or strain. On plotting from these results the stress strain curve and the stress time curve, it is found that they were identical when the scales correspond.

Mr. Pearson: Whilst listening to Mr. Wright's very able paper, I have been brought to look upon the action of stress upon the elements that compose iron and steel in a different light from what I have hitherto regarded it. When such building materials as stone and wood are subjected to stress one can readily understand the action that takes place. In the first instance, when stone is subjected to pressure, the small molecules are disrupted from their setting in the basic cement and the material begins to fracture and crumble away. In the case of wood, the fibres begin to slip past or tear apart from each other. Now, in the case of steel, if I understand Mr. Wright, this action is altogether different. When stress is applied the substance begins to flow. Perhaps I should not say altogether different, but the nature of the substance, as we conceive it is so very different from that of stone or wood, in that it is a more unified or compact mass, that the strain, the resultant of the stress, travels through it, or is transmitted, or flows through it, more in unison with the inherent conditions that are generated by the stress. There is a something in the nature of steel, its elasticity, its plasticity, its resilience, its resistance, its recuperative powers, in that up to a certain point it will again assert itself, or assume



FIG, 4.

its normal condition—that, of all the materials we employ, places it in a class by itself. Now it is because of these integral qualities, that there is a greater unison, a closer affinity between the elements that compose steel and the conditions that arise when strain is present. What is this substance, what is—steel? We seem to know very little about it. We understand it to be composed of innumerable crystals, and these crystals, I suppose, are composed of atoms. Now, imagine a

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piece of steel under compression; the atoms or crystals that compose it begin to flow. Are these crystals of such hardness and density that they cannot assume another form and therefore must necessarily move around or upon each other, or do they adapt themselves to the conditions and elongate and compress inherently? What is this adhesive property that binds them together under stress, as the substance itself becomes more compact or elongated? Is it a cement? Is it the attraction of the atoms themselves? It seems to me we want to know more about the composition of steel, its simple elements and their properties, before we can understand the action of strain in the substance. It may be the association of ideas, but when Mr. Wright used the word flow, I immediately thought ot liquids, (Laughter), and I think it would enable us to understand more clearly the action of stress on steel if we could conceive it as a rigid fluid. I would qualify the adjective to the extent of the action of stress upon steel; or, take a bar of soap and we can more readily understand this action of compression or elongation. Mr. Wright has shown us a number of tests with widely differing results, and in some cases by merely hardening the steel, the results vary from twenty-five to fifty per cent. He has carefully led us step by step into such a bewildering maze of tests and figures, and left us there, that I think we feel justified in asking him to tell us what factor of safety we are to employ in the future. (Hear, hear.) In the earlier part of his paper Mr. Wright briefly touched upon the architectural aspect of engineering, wondering if it were not possible for the architect to evolve an aesthetic section of a steel beam or column, exposing them and treating them as part of the design. There are tremendous possibilities in this proposition. Imagine the section of a steel beam in the Queen Anne style, or a Romanesque channel, and then think of it—think of the midnight oil consumed by the engineer in locating the elusive "moment of enertia" or the "radius of gyration" of such fantastic shapes! (Laughter). Until a fire-resisting steel is manufactured, or a steel of something more than the nondescript colour it is at present, a colour that is pleasing and integral, we are justified in painting to get the desired effect, or in covering with such materials as will protect it against fire. (Hear, hear). From the standpoint of economics, in that the shapes that are rolled are universal and are of such contour that they lend themselves readily for assembling, in that the effort is to obtain the greatest strength with the least area of cross-section, or until that day dawneth when we shall view with a sense of exquisite pleasure the lines of a Z bar column, let us "rather bear the ills we have than fly to others we know not of." It is beyond question that the science of engineering has kept pace with the times, manfully meeting and solving the problems that the advancement of civilization unearthed, whilst its kindred profession has been content with the laurels gained in An-

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cient Greece and the Middle Ages. One of the conditions brought about by the rapid growth of our cities is the necessity for more floor space within a limited area, and in order to accomplish this buildings of graded heights have been erected, finally culminating in the modern sky-scraper. For the solution of these problems it was necessary to appeal to the engineer; and mark how carefully, step by step, he has dragged us with him into the vortex at the imminent risk of losing our reputation—our fair heritage of centuries of standing. (Hear, hear). No sooner was the problem of the seven-story building solved than he insinuatingly suggests ten, and so on, worming his way insidiously, Uriah Heep fashion, until finally he takes the reins out of our hands and is dragging us, wither knows, ever onward, higher and higher, our fates indissolubly linked together, for each art is interdependant. He ruthlessly tramples all our aesthetic feelings under foot, turns a deaf ear to all our cries and protestations, and as already pointed out to him by someone, he looks not upon the sanitary aspect of this question—the damp, unwholesome and microbe-laden air, which must lurk in the deep ditches of streets between these mountainous structures, the dark, untenable, uninviting offices of the ground floor and the congested condition of the sidewalks, when the vertical carrying capacity exceeds the horizontal. But there is no turning back in his mad career: his day has come and he is stung to greater madness, when he thinks of the long-continued sway of the noble art of architecture. Why cannot his profession be characterized a noble art? And in his hallucination he drags his now passive brother to his destruction, until finally he lands him, a drivelling, ornamental draughtsman, to pilaster, and be-cornice and drape his awful Eiffel Towers. (Laugher and applause). Gentlemen, I think our heartiest thanks are due Professor Wright for his paper and in moving this vote of thanks I take this opportunity, now that we are all assembled together, to make mention of the deep interest he takes in this Association—a working interest, not a passive interest, that costs but little. He is always willing to saddle himself with work, and the thorough manner in which he goes

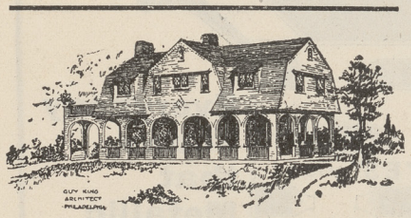
The Samson Cordage Works, of Boston, are sending out a very neat desk calendar, showing sample of their cord, and table of sizes and weights.

We have received from The B. Greening Wire Co., Limited, Hamilton, an advance copy of their annual calendar for 1902, which no doubt will be much appreciated. The leading feature is good bold type that can be read from some distance. The extra spaces of each month are filled in with attractive cuts illustrating the principal seasonable lines of manufacture. We are pleased to hear that this enterprising firm have had a very successful year's business, and have in contemplation some important changes. Contracts will be signed in a few days for the erection of fine new offices. Plans are being prepared for a large new paint tower. Their last catalogue was issued January, 1900, and should be in every architect's office.

STONE.

Contractors can be supplied with all kinds of stones—Rubble Coursers, all thicknesses, Footing Stone, Flagging, Crushed Stone, Grey lime, at the Horse Shoe Quarry, St. Marys, Ont., at reasonable prices, in quarry or f.o.b. cars at St. Marys, or destination. Also an analysis of their stone for refining purposes or a flux.

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EXAMINATION TO QUALIFY FOR ASSOCIATESHIP IN THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

The Royal Institute of British Architects desiring to give facilities for those in the Colonies to qualify by examination for associateship in the R. I. B. A., will hold the second examination from July 4th to 10th, 1902, in Montreal. Applications, fees and probationary work must reach London not later than May 5th, 1902. Intending candidates who must be over 25 years of age, can obtain application forms and copies of the previous examinations on application to

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All who are full members of the Province of Quebec Association of Architects and the Ontario Association of Architects by examination are exempt from probationary work.

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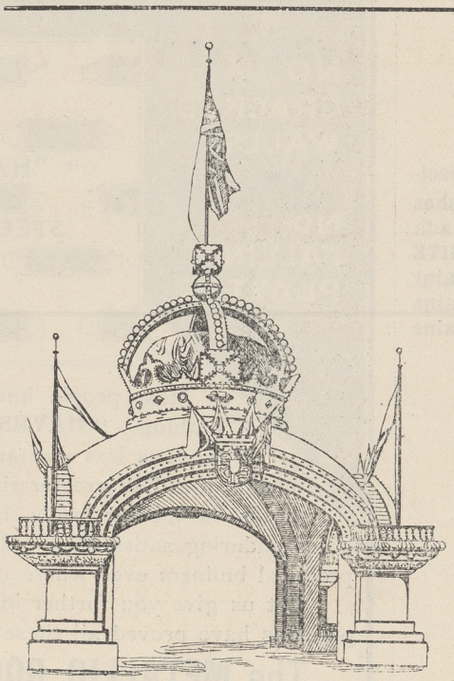
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THE CANADIAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the above Society will be held in the Society's rooms, 877 Dorchester Street, Montreal, on Monday and Tuesday, the 27th and 28th inst., beginning at 10 o'clock a. m., on first mentioned day. In addition to the business session, tea will be served from 4.30 to 6 o'clock on Monday, and at 8.30 p. m., a lecture will be given by Wallace C. Johnson, M. Can. Soc. C. E., on the "Shawinigan Water & Power Development." Tuesday will be spent in inspecting the water power development works of the Shawinigan Water & Power Company at Shawinigan Falls, Que. On Tuesday evening the annual dinner of the Society will take place at the Place Viger Hotel.

METHOD OF HEATING A LONDON THEATRE.

The Theatre Royal, Drury Lane, London, has recently been entirely remodeled inside, but perhaps one of the greatest improvements effected is in regard to the warming and ventilating. The theatre was previously very draughty, and in the stalls especially it was very cold to the feet, the floor being like the floor of an ice-house. All this has been altered, and when the new installation is complete such troubles will be a thing of the past. The theatre proper and stage contain together half a million cubic feet of space, and it has not been an easy matter to deal with such a large building, but fresh air is now introduced from the outside by means of three powerful fans, driven by electric motors. Before this fresh air is blown into the theatre it has to pass through a filter screen constructed of coke, which takes out all the dust and smut. The fans are sufficiently powerful to change the whole of the air in the theatre five times per hour, and this means that three hundred and eighty tons of fresh air will be blown in during the average performance of four hours' duration. The temperature of the air is warmed to any desired degree, and this is so distributed that no draughts are felt. The effect of blowing the air instead of exhausting—the usual custom—is that the air from the theatre passes out at all doors and crevices, and draughts are completely avoided.

NOTES.

A unique and handsome new year greeting card was issued by the Dominion Radiator Co. Below the reminder that "Time Flies" Father Time is depicted as making his exit, but the reader is assured that "Safford Stays Forever." The company's exhibit at the Glasgow Exhibition received the highest award in the British Section.

A Chicago despatch announces the consolidation of twenty-five companies to control the principal gypsum deposits of the United States. The new organization will be known as the United States Gypsum Company, and will have a capital of $10,000,000. The Company state their purpose to develop the use of gypsum in the manufacture of plaster as against that of lime.

The Horseshoe Quarry Company have lately opened up a new stone quarry at St. Marys, Ont., from which can be obtained unlimited quantities of stone of excellent quality. The proprietors have built a switch three-quarters of a mile in length, connecting the quarry with the main line of the Grand Trunk railway, and are thus in a position to supply any quantity or size of stone required.

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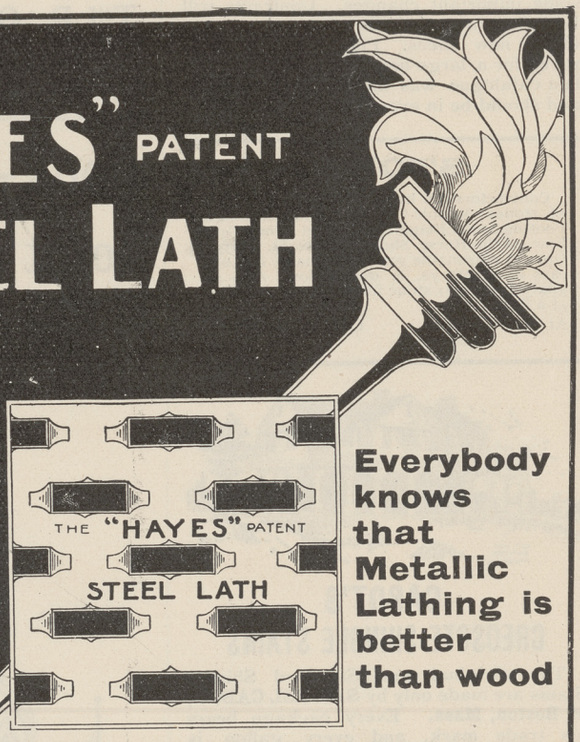
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about it and the care and pains he takes with it should evoke our warmest appreciation; and all this voluntary work added to his multitudinous duties at the School. If it were not that he best illustrates it himself in the paper he has given us, "The Behavior of Steel Under Stress," I would feel called upon to take up more of your time and tell you of the behavior of Wright under stress. (Applause.)

PERSONAL.

Mr. S. G. Curry, a well known Toronto Architect, has been elected a member of the City Council.

The Toronto Builders' Exchange have elected as their representative on the Board of Management of the Toronto Technical School Mr. Jas. D. Allan.

Messrs. John Gemmell and John A. Pearson have been elected to represent the Ontario Association of Architects on the Board of Management of the Toronto Technical School.

Mr. Wm. J. Smith, formerly a well known builder and contractor, and later on superintendent of public buildings for the Dominion Government at Toronto, died in that city a fortnight ago, aged 61 years.

Miles Vokes, of the Vokes Hardware Company, and J. M. Taylor, manager of the Dominion Radiator Company, have been elected to the Executive Committee of the Hardware Section of the Toronto Board of Trade.

R. I. B. A. EXAMINATIONS.

The attention of our readers is directed to the advertisement appearing in this number giving particulars of the R. I. B. A. Examinations to be held in Canada from July 4th to 10th, in Montreal. At the first examinations held in Canada last year several candidates presented themselves, and one, Mr. Andrew Sharp, succeeded in passing.

BUILDING IN MONTREAL.

The second annual report of Mr. Chausse, Building Inspector, states that during 1901 there were erected 443 new buildings valued at $2,568,378, and alterations to buildings costing $332,361, the total expenditure being $2,900,733 as compared with $3,084,403 in 1900, and $2,370,080 in 1899. The Inspector reports last year as having been the busiest in the history of his department, extra work being imposed by the new building by-law. He requests the Council to appoint an assistant inspector in order that the by-law may be properly enforced.

Very satisfactory progress has been made with the construction of the new Toronto hotel. The first five storeys have been completed and closed in, and work is proceeding on the interior. It has recently been decided to increase the height of the building by two storeys which, in addition to giving increased accommodation will improve the appearance.

The Bricklayers' Union of Toronto is said to be considering the advisability of making a demand for an increase in the rate of wages at the termination of their present agreement with the employers on May 1st next. It is reported that this demand will be for an increase of 7 cents per hour, which, if granted, would bring the rate per hour up to 45 cents. The builders' laborers are said to be considering a similar proposition, while the Teamsters' Union have already notified the contractors that after the 1st of May they will demand 45 cents per hour. The Plasterers' Union have made an agreement with the Builders' Exchange at 38 cents per hour. It will thus be seen that there is likely to be a demand all along the line for increase of pay. It is to be hoped that the effect of this announcement made so early in the year may not be prejudicial to the starting of new building projects.

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Light, Heat and Power in Buildings, by Alton D. Adams, Member American Institute of Electrical Engineers. One 12 mo. vol., cloth; 102 pp. Price $1. New York, W. T. Comstock.

This book is intended as a convenient manual on the subjects treated, its object being to present in compact form the main facts on which selections of the sources for light, heat and power in buildings should be based. The feature of special interest in the work and its main novelty, that of arrangement by cost of service from widely different sources, are set down side by side.

The American League for Civic Improvement, whose headquarters are at Springfield, Ohio, has published in an 80 page booklet entitled The Twentieth Century City, the proceedings of the annual convention of the League held at Buffalo in August of last year. Not the least important of the suggestions is the action of the Convention, urging the provision at the St. Louis Exposition of an object lesson in modern city making by the arrangement of a model city, not on a small scale, but "life size."

The effect of artificial light on colours is sometimes overlooked when choosing a decorative scheme. The fact is, gas and electric light will change colours wonderfully. Yellow is paled and sometimes wholly lost; certain blues turn black; other blues, absorbing the yellow light, become green; such colours as violet, pink or purple are entirely altered. To guard against disagreeable effects, the colours used should be so selected and juxtaposed that the finished work will look as well by night as by day, even though the whole will be somewhat changed in tone.

Recently published statistics of the mineral production of Canada show an increase of 67 per pent. since 1890, the total being now $6,285,000 as compared with $3,761,000 in 1890. A large item in the increase is Portland cement, the manufacture of which is increasing at a very rapid rate. Canada now manufacturers 283,000 barrels per year, or about 50 per cent. of the quantity consumed.

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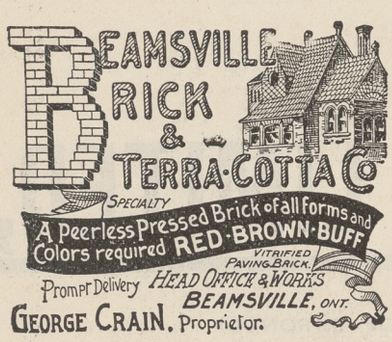
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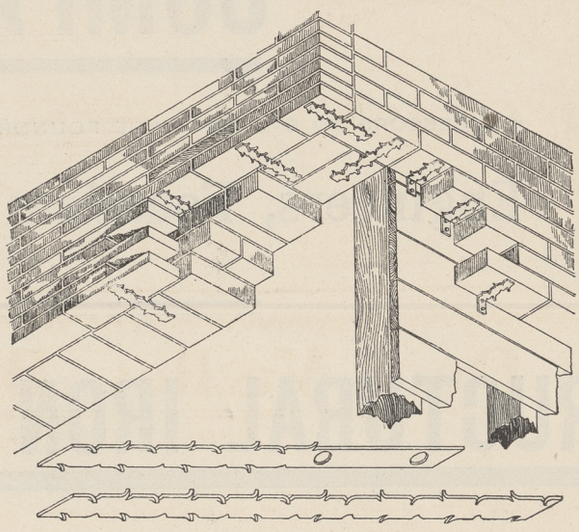
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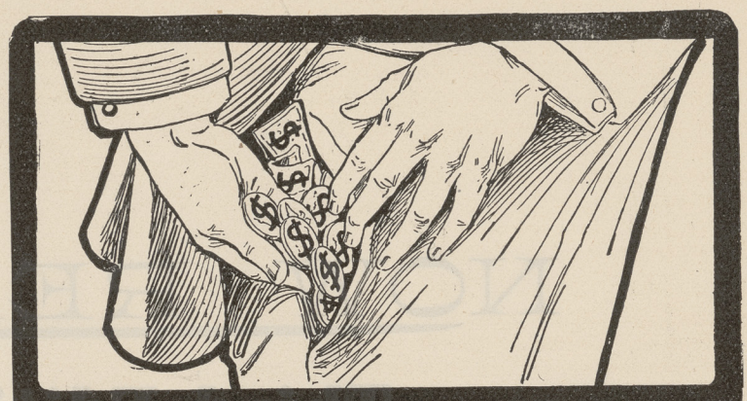


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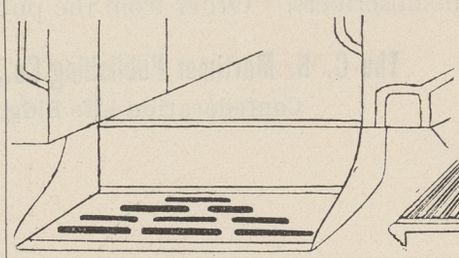
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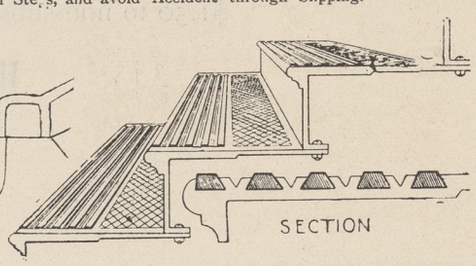
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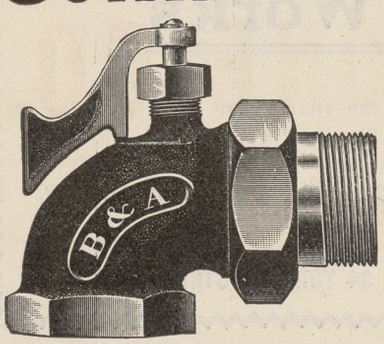
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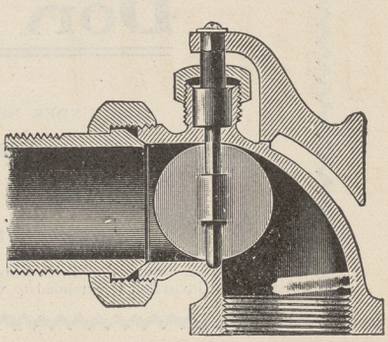
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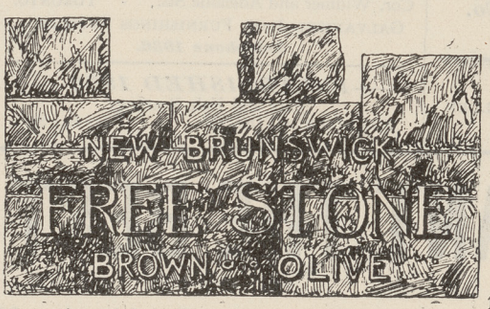
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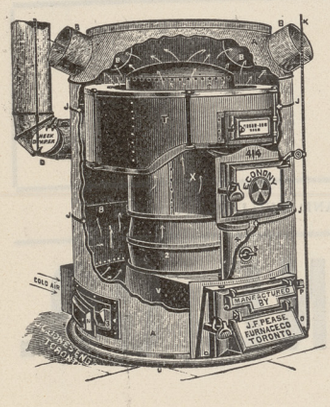
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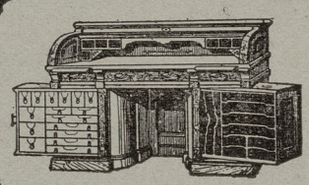
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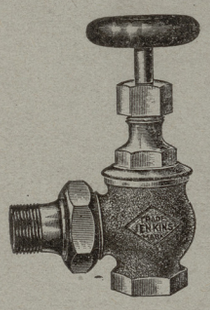
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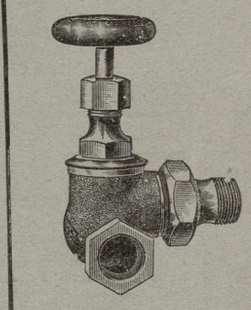
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